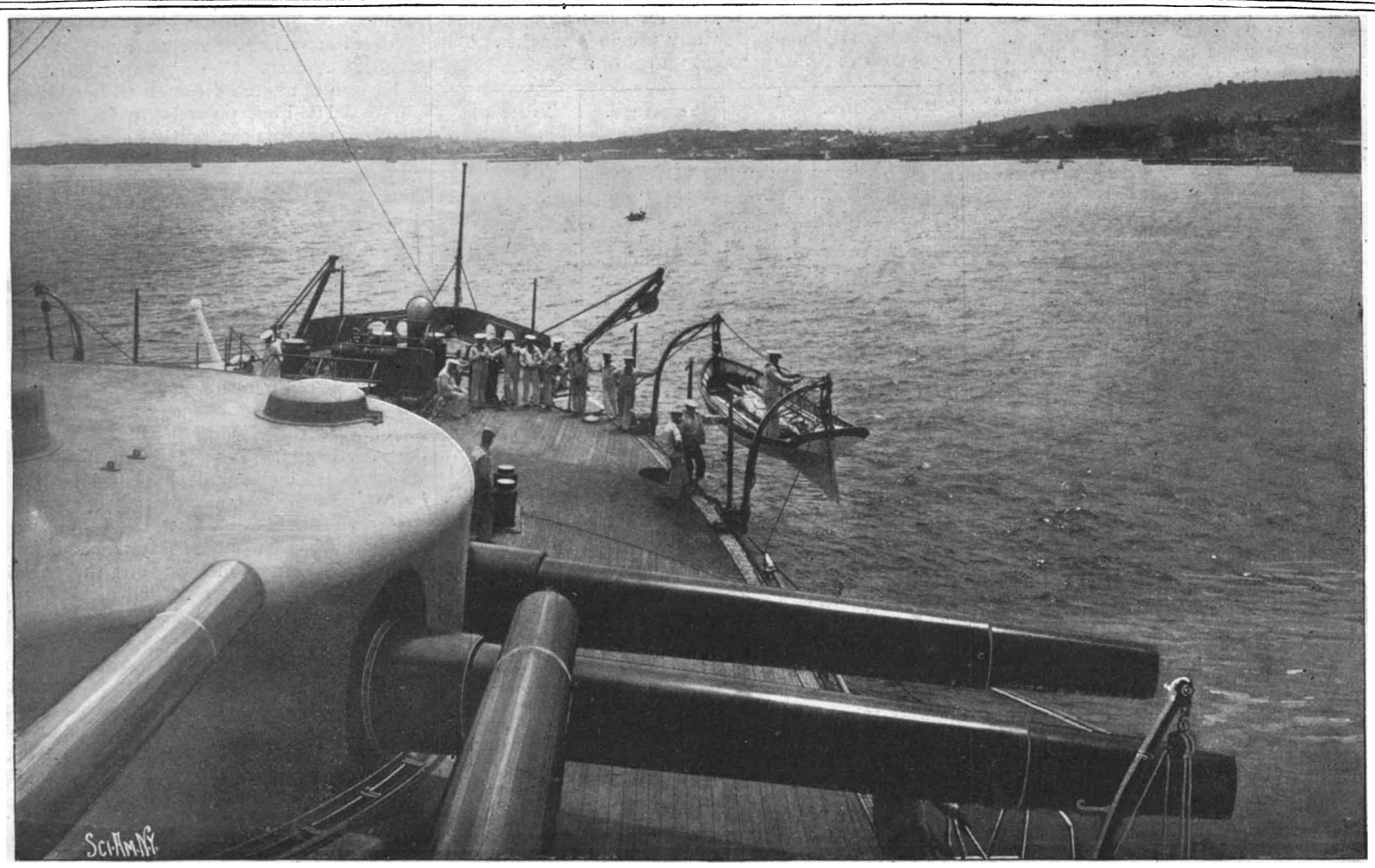
SCIENTIFIC AMERICAN

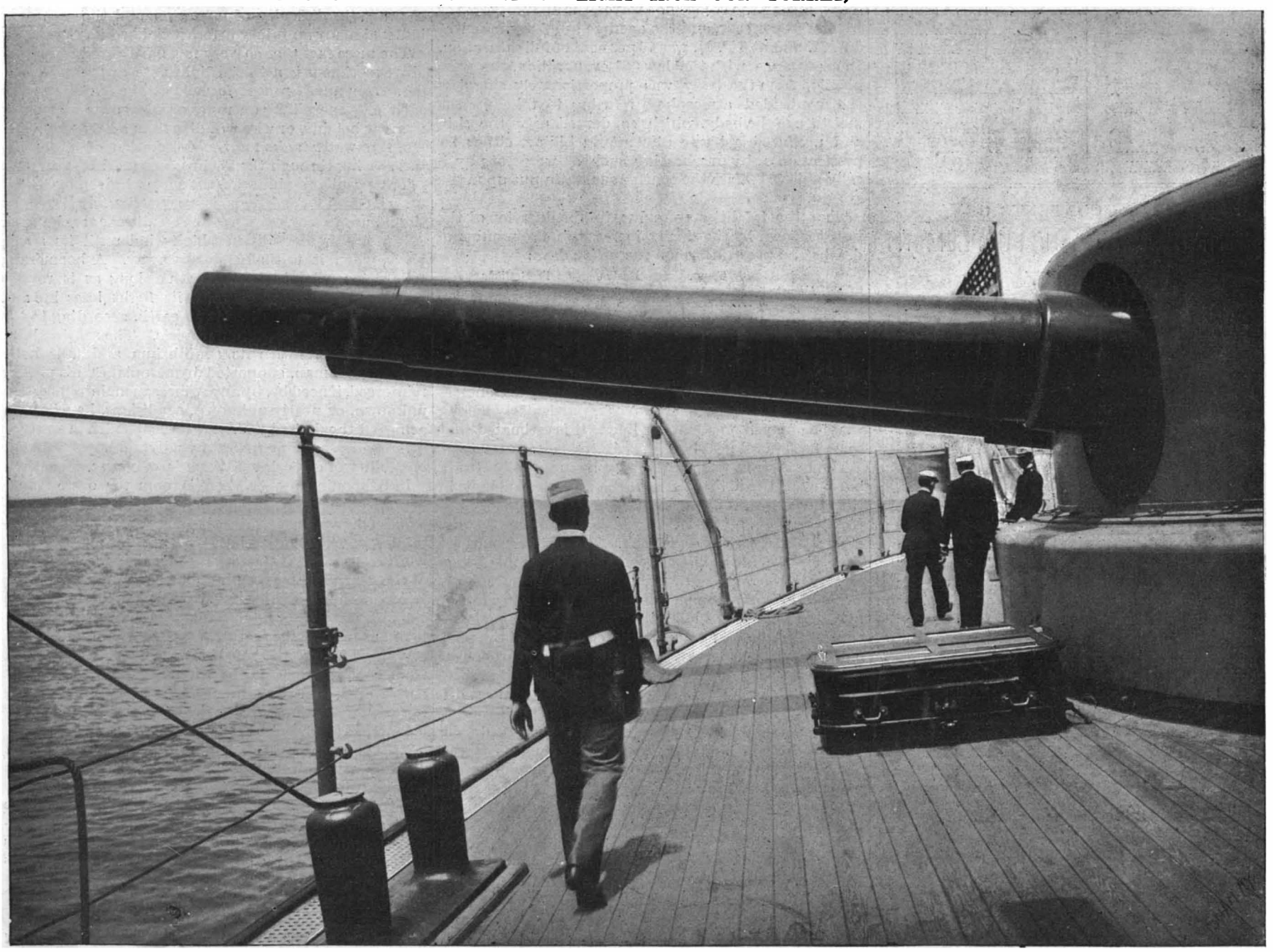
[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyright, 1896, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXV.—No. 8. ESTABLISHED 1845. NEW YORK, AUGUST 22, 1896. $3.00 A YEAR WEEKLY.

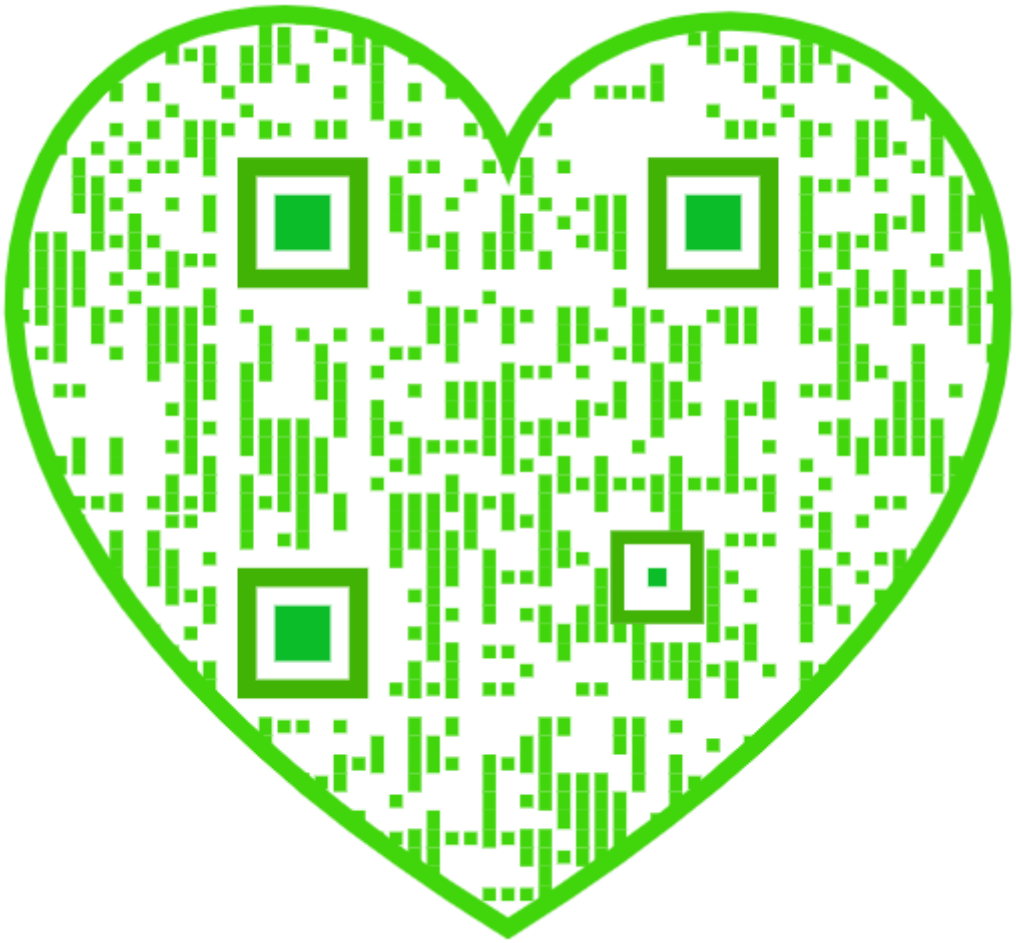


THE INDIANA—VIEW FROM TOP OF EIGHT INCH GUN TURRET, LOOKING FORWARD.



THE BATTLESHIP INDIANA—THE GREAT THIRTEEN INCH GUNS SWUNG OVER TO STARBOARD.—[See page 172.]

© 1896 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

(Established 1876.)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year.*

Building Edition of Scientific American.

(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American

(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, AUGUST 22, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

Ammunition hoists battleship Indiana*..... 172
Baths, thermal, Lamalou..... 173
Books and publications, new..... 176
Britannic steamer, good work of 167
Coal consumption..... 169
Colors, surface 168
Comet, Brooks*..... 174
Cope, E. D.*..... 170
Cycle notes..... 174
Dry dock accident, N. Y. navy yard*..... 168
Eclipse of the sun, August 8..... 167
Electric scorer, an..... 168
Expedition, polar, Nansen's*..... 171
Exposition, Brussels, 1897..... 173
Fair, American Institute..... 174
Flies on cattle, remedy..... 171
Flight, artificial..... 166
Forestry as a science..... 173
Gas exhibition, New York..... 173
"Good will"..... 167
Guns of the battleship Indiana* 165, 172
Heat wave, the recent..... 166
Historic tablet, a great..... 170
Ice house damp (6936)..... 177
Indiana, battleship, the*..... 165
Inventions recently patented... 176
Japanese cathedral, a new..... 169
Kelvin, Lord, and his note book 169
Krupp works, the..... 175
Lilienthal Otto..... 167
Lock, the Yale..... 175
Locomotive, a recent English*.. 169
Machinery exhibit in China..... 174
Medals for inventors..... 174
Microscopic projections (6933)... 176
Molybdenum bronzes by electrolysis..... 170
Newton, Hubert Anson..... 167
Notes and queries 176
Photographic negatives, retouching (6937)..... 177
Photography, hints to beginners 167
Rifle, kick of a..... 167
Science notes..... 174
Sewer gas trap, Dehn's*..... 168
Shoe polishes (6931)..... 176
St. Paul steamer, fast trip of.... 167
Sugar juice, etc., apparatus for treating*..... 168
Water supply, Paris and London 174
Zinc etching, the discoverer of 170

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1077.

For the Week Ending August 22, 1896.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BIOLOGY.—The Invisible Food of Fish.—The food of fish and the role played in it by the lower forms of life..... 17217

II. CYCLING.—Cycle Mechanics.—By H. K. LANDES.—A thoroughly scientific investigation of the mechanical problems in the modern bicycle.—4 illustrations..... 17212

III. ELECTRICAL ENGINEERING.—Electric Furnaces and the Conversion of Carbon into Graphite.—A valuable article on the different electric furnaces used for commercial purposes.—13 illustrations..... 17215

IV. ENTOMOLOGY.—The Shade Tree Insect Problem in the Eastern United States.—The Fall Webworm.—Conclusion of this official paper, treating of the fall webworm, its ravages and how to cope with them; the relative immunity from insects of different varieties of shade trees. 3 illustrations..... 17220

V. MECHANICAL ENGINEERING.—A New Steam Trap.—A new trap for collecting drainage water from steam pipes.—3 illustrations..... 17213

Punching and Shearing.—By PAYSON BURLEIGH.—An article on the effects of manipulating steel and the results of fast and slow motion..... 17209

Special Shearing Machine.—A machine for cutting up discarded locomotive boilers into workable scrap.—1 illustration..... 17214

VI. METALLURGY.—Cleaning Cavities in Metal Work.—Some excellent hints on foundry practices in brass and iron..... 17211

VII. METEOROLOGY.—Italian Thunderstorms..... 17222

VIII. MINING ENGINEERING.—The Action of Electric Currents on Mine Surveying Instruments.—An abstract of a paper on a curious difficulty recently experienced in mine surveying..... 17214

IX. MISCELLANEOUS.—$250 Prize Essay Competition.—The Progress of Invention During the Past Fifty Years.—Fifth prize, won by "Verbum Sap III," Frederic de Garis.—Fifth prize essay in this notable competition..... 17219

The Development of Newfoundland.—A most interesting article on this little known island.—Recent railroad construction and the prospects of the interior..... 17221

Cockroach Exterminator..... 17217
Engineering Notes..... 17218
Electrical Notes..... 17218
Miscellaneous Notes..... 17218
Selected Formulæ..... 17219

X. PHOTOGRAPHY.—Telescopic Photography for Amateurs.—By JOHN MILLS.—How to take photographs of celestial objects with simple appliances.—6 illustrations..... 17217

XI. RAILROAD ENGINEERING. Gas Motor Tram Cars.—A new type of tram car recently tried near Liverpool.—4 illustrations... 17210

Rack Railways.—An exhaustive and valuable article on the rack railroads of Europe, with numerous illustrations of scenes on the roads and of an American rack rail engine.—8 illustrations..... 17207

XII. TECHNOLOGY.—Hints on Baking Enamel.—An article on japanning, with special reference to bicycle frames..... 17213

Replishing Japanned Work.—A valuable contribution to the literature of japanning, with special reference to sewing machine work..... 17210

Sticky Fly Paper.—The factory making the greatest part of the world's supply.—Interesting example of the maintenance of a trade secret..... 17216

THE RECENT HEAT WAVE.

The phenomenal heat wave which has recently passed over the Eastern States was marked by a long list of fatalities to man and beast, and will be memorable in the meteorological records as one of the longest and most destructive visitations of the kind on record. The temperature readings of the United States Weather Bureau in New York City, which cover a period of twenty-six years, can show no parallel, for the month of August, to the heat of the nine days from August 4 to August 12 of the present year. It is true that in certain previous years the temperature for any particular day of the nine may have been exceeded, but in such cases the rise of temperature has been temporary. The general average for these nine days has never been approached in any previous August. The temperature readings are given below:

Date.	Temperature.	Exceeded in
August 4	87 degrees.	1873, 1881, 1888.
" 5	89 "	1881.
" 6	91 "	1881.
" 7	91 "	Maximum.
" 8	92 "	Maximum.
" 9	90 "	1888, 1892.
" 10	91 "	1894.
" 11	94 "	Maximum.
" 12	92 "	Maximum.

The readings of the New York City Bureau are taken from thermometers on the top of the Manhattan Life building, at an elevation of 298 feet above mean sea level. It is considered that this great elevation is favorable to a correct record of the passing heat waves, inasmuch as the instruments are free from the local variations which are caused by radiation and reflection from the pavements and walls of the city below. It is undeniable that the heat in the streets of the city and in its stores and offices has often risen many degrees higher than the official records, and a street temperature of from 97 to 103 degrees has been common on such days as the 8th, 11th and 12th instant.

To residents in some of the Western States, such, for instance, as Arizona, where from 110 to 115 in the shade is not uncommon, there may seem to be nothing phenomenal in these New York temperatures, and the terrible fatality which accompanies them will be a mystery. The fatalities are to be ascribed to the accompanying humidity of the atmosphere and to the fact that the victims are unaccustomed to, and quite unable to endure, a spell of heat of such long continuance. The air of Arizona, moreover, is extremely dry, and the evaporation from the body is proportionately rapid, bringing instant and continual relief to the system. In New York, during the recent hot waves, the humidity rose as high as 93 per cent, and the average humidity taken at 8 A. M. and at 8 P. M. was 73 per cent of full saturation. In accordance with the laws of evaporation, the perspiration from the body was proportionately sluggish, the overloaded atmosphere refusing to take up the moisture of the body, which condensed upon the skin and produced extreme discomfort; killing, either by prostration or by overheating, such as were not physically able to endure the continuous strain put upon the system.

That the fatalities were due to the duration of the heat is shown by the steady increase in the number of deaths and prostrations on successive days:

	Temp.	Deaths.	Prostrations.
August 5	89	3	29
" 6	91	7	31
" 7	91	7	56
" 8	92	14	61
" 9	90	72	78
" 10	91	163	182
" 11	94	182	350
" 12	92	177	467

The heat wrought terrible havoc among the horses employed in the city of New York, particularly among those employed on street car lines. It is estimated that some 1,500 in all perished.

The heat wave was marked by an unusually steady barometer, the highest readings on the instrument in the SCIENTIFIC AMERICAN office being 30·03 inches, and the lowest 29·85, a variation for the nine days of only eighteen-hundredths of an inch. This will account for the absence of cooling breezes, which contributed largely to the oppressive humidity of the atmosphere.

The fatalities accompanying this spell of hot weather bring to mind the similar scourge—it is nothing less—that visited Australia during the early part of the present year, when for two weeks the temperature never fell below 90 degrees in the shade, and in some localities rose as high as 122 degrees. The Australian heat differed from this in New York in the fact that it was accompanied, and largely caused, by a strong wind from the interior, which was intensely dry and hot and caused the drying up of rivers and streams, burning up the crops and killing the cattle in the fields. As in the Eastern States, people were sunstruck and horses dropped in the streets.

It is probably more than a coincidence that heat waves of unprecedented power and duration should have visited the three continents of Australia, America, and Europe in the same year; and science has yet to discover the influences which determine their coming and going.

ARTIFICIAL FLIGHT.

The problem of artificial flight has recently received several additions to its history, additions which will make the present epoch an important one if the problem is ever to be solved. For of course if it prove insoluble and if it is relegated to the limbo of abandoned efforts, and to the realms of the impossible, the death of the most successful human soarer, the flight of the most successful mechanical soaring machine, the partial success and wreck of Maxim's apparatus and the work of Andrée's balloon will be of little interest. But if man does learn to fly by mechanical means, or even to float for an indefinite period by a balloon, then Lilienthal's death, the half mile flight of Langley's machine, and the other achievements will be a group of notable occurrences. Slowly a tangible theory of soaring has been evolved. The support given to an aeroplane in horizontal motion through air has been experimentally tested and has proved surprisingly great. The fact that air currents constantly vary in velocity gives the quality of internal energy to the air in reference to a body suspended in it, which energy it appears might be adequate to support a body whose inertia enables it to utilize these changes in wind velocity for its own support. Again, an upward component of winds has been recognized, which by a parachutelike action would go to arrest the descent of an aeroplane, and help to support it.

Working on these bases, it appears that a soaring bird, with exquisite balancing, presents a surface of wing to the air which blows against it with varying velocity. The inertia of the bird's mass preventing it from yielding to the frequent changes acts like a kite string to hold it relatively fixed in face of the wind pressure or of portions thereof. These fractional portions of the wind, acting on the inclined plane formed by the under surface of the wings, would uniformly operate to push it up against the force of gravity.

Lilienthal, enamored of the problem, found that it involved as its most difficult part the question of safe alighting. Flying for a limited distance proved comparatively simple. Starting from his elevated platform, he performed many flights and soared for considerable distances. The erratic nature of the flights, sometimes involving a rise in the air, showed how great were the reserve powers in a heavy body moving on aeroplanes—powers which human ingenuity seemed unable to fully utilize. The instant changes in direction to which a moving aeroplane is subject, and its dependence for action on motion, actual or relative, make it an exceedingly difficult engine to manipulate. This fact led to many accidents to Lilienthal, and finally to his death. It required an intrepid experimenter to trust himself to the support of the air. Accident after accident went to prove the difficulty of operation, and the aeroplane inflicted many an injury before it claimed its victim.

The mere fact that so very few have dared to personally experiment in artificial flight goes to prove its danger. Any number of performers can be found to essay such feats as walking on ropes or wires over abysses or at great heights, or who will dive from a height of many feet into water tanks for the delectation of audiences, but soaring through the air has been tried by very few.

The peculiar stability of the support given by the air under certain conditions is very strikingly shown by the failure to support when the conditions are changed. A kite floats peacefully in a high wind until its string parts, when it floats helplessly away. A boomerang follows its curiously definite path as long as it rotates rapidly. As the rotation fails, its flight loses life and it drops more or less directly to earth, according to the extent to which its rotation persists. The soaring bird, when shot, parts with its equilibrium and falls helpless. When man, supported by aeroplanes, his powers reinforced, if need be, by an engine, can maintain certain unknown, or nearly unknown, conditions, he will have achieved the desired end. But the conditions are so little understood as to be virtually unknown, and the possibility of disposing of them is, of course, uncertain.

In ballooning proper there is room for one advance which, once made, would seriously modify the problem. This advance is in the construction of the containing envelope or gas bag. All that has made balloon work so very unsatisfactory is the leakage and diffusion of the gas. The fact that a balloon cannot be driven in any desired direction is a trouble less in degree than the impossibility of maintaining its buoyancy. A balloon has to be made of extra capacity to admit of the carrying of a quantity of ballast, which is discharged from time to time as the buoyancy diminishes. The entire area of the cloth envelope must be pictured as full of pores, through which the contents are constantly escaping, and through which air is more slowly entering. This action takes place independent of any pressure, owing to the buoyancy of its contents, which may exist in the gas bag.

With a really impervious envelope a balloon could be kept afloat indefinitely. Its flotation could be regulated by pumping gas out of the envelope into cylinders under pressure or by admitting it from such cylinders into the envelope. The clumsy sand bag would no longer be required, and the drag rope would prove ample to regulate the height of flight.

The most serious attempt at advanced ballooning is

© 1896 SCIENTIFIC AMERICAN, INC.

that of M. Andrée, who hopes to explore the north polar regions in a balloon. The last refinements of the aeronaut's art are represented in it; an elaborate outfit of meteorological instruments are mounted; and the drag ropes even are of improved construction. We have already published a number of articles describing this balloon.* But what is most extraordinary is that it is claimed that its envelope is almost impervious to gas. If this prove true in practice and actual use, then the balloon will take a new position among the resources of the scientist. The inevitable loss of buoyancy, which has hitherto made ballooning so dangerous and unsatisfactory, being once disposed of, the new condition opens up a wide scope of possibilities for the explorer. Hitherto the danger of being blown out to sea in a balloon involved the certainty of an enforced descent into the ocean. Without such result the departure from the land area would be of minor importance and the old ideal of finding at some altitude a wind of the desired direction would seem possible of realization.

Soon more will be known of all these things. Langley's work, it is to be hoped, will soon be described in extenso and the result of Andrée's exhibition will be eagerly watched for. Nansen is reported as having got within a few degrees of the north pole by sea. Andrée and his collaborators may yet be destined to look down upon the unknown axial region of the terrestrial sphere.

Death of Otto Lilienthal.

Herr Lilienthal, an engineer, who for many years was experimenting in the building of flying machines, met with an accident on August 11 that resulted in his death. He started with one of his machines to fly from a hilltop at Rhinow, near Berlin. The apparatus worked all right for a few minutes, and Lilienthal flew quite a distance, when suddenly the machinery of the apparatus got out of order, and man and machine fell to the ground. Lilienthal was so badly injured that he died in the hospital to which he was removed.

Herr Otto Lilienthal was born in Anklam, near the Baltic coast of Pomerania, about forty-seven years ago. He attained considerable celebrity by the invention of his machine, which was modeled on that of a bird's wing, and he was generally known as "the flying man." Herr Lilienthal was an engineer, and established in Berlin a manufactory of small steam engines, where the mechanical appliances furnished him with every facility for the construction of his flying apparatus. He often succeeded in keeping in the air for some time with the aid of his artificial wings, which seemed to be adapted rather for soaring than for flying in the proper sense of the term. His machine was made almost entirely of closely woven muslin, washed with collodion to render it impervious to air, and stretched upon a ribbed frame of split willow, which was found to be the lightest and strongest material for this purpose. During the past two or three years he gave much attention to motive force, and reached the conclusion that the vapor of liquid carbonic acid would be effective.

Hubert Anson Newton.

The world of science is poorer by the loss of Hubert Anson Newton, who for the past forty years has had charge of the mathematical department of Yale College, his election to the chair having taken place in 1855, and his active occupation of it dating from a year later. He is best known in scientific literature by his investigations of the laws governing meteoric and other similar bodies. He demonstrated that the period of revolution of the shooting stars known as November showers "must have one of five accurately determined values." His computations were followed up by other authorities, so that it became possible to connect these meteors with the comet of 1866. He determined the numbers and frequency of the sporadic meteors in the earth's orbit, and proved that they moved in long orbits like that of the comets. He was instrumental in having the metric system of weights and measures introduced into the arithmetics of this country.

In 1868 he received the degree of LL.D. from the University of Michigan. He was one of the men originally appointed by Congress to constitute the National Academy of Sciences. He was elected an associate of the Royal Astronomical Society of London in 1872 and a fellow of the Royal Philosophical Society of Edinburgh in 1886. He had been president of the Connecticut Academy of Arts and Sciences. He was a member of the American Association for the Advancement of Science from 1850, its vice-president in 1875 and its president in 1885.

Yale College is greatly indebted to the zeal and counsels of Prof. Newton. He was associate editor of the American Journal of Science and his writings consisted largely of memoirs of the National Academy of Sciences.

A NEW terramara, or prehistoric settlement, 500 yards long by 250 yards wide, has been discovered at Castenaso, near Bologna, Italy.

* SCIENTIFIC AMERICAN, vol. 73, No. 2; vol. 75, No. 7. SUPPLEMENT Nos. 1026, 1027, 1067.

The Total Eclipse of the Sun.

On August 8 a total eclipse of the sun occurred, the first since 1893. It was visible in localities along the north coast of the European continent, thence along a diagonal path through Siberia and Japan and out on the Pacific Ocean. Naturally very elaborate preparations were made to observe it, especially for the study of the corona. Amherst College, under Prof. D. P. Todd, sent out an extensive expedition, which had the service of the yacht Coronet, owned by D. Willis James, whose liberal owner is responsible for the expedition. This party went to Japan, and near it was established the Lick Observatory party under Prof. J. M. Schaeberle. In Nova Zembia and Siberia there were four Russian posts, and all along the path amateur and professional observers were distributed. The general résumé of reports, as far as received, is to the effect that comparatively little of value was done, owing to unfavorable climatic conditions, clouds interposing to prevent the success of the observers. This has happened to so many expeditions for the observation of total eclipses that it is a misfortune that will always be anticipated as highly probable. Of the recent total eclipses good observations were secured on the Caroline Islands in a total eclipse in 1883, although there was a narrow escape, as the morning of the day was showery, but just before the eclipse the sky cleared. In 1886 some observations were successful, while the weather interfered with those at other stations. The eclipse of 1887 was not observed at all, owing to the clouds. Of the last eclipse of April 16, 1893, and one or two preceding ones, excellent observations were obtained.

Hints to Beginners in Photography.

BY ROBERT GRIMSHAW.

Many amateurs do not succeed in getting creditable pictures, even with good cameras, first, because they do not understand the general principles of optics, and second, because they do not know the special peculiarities and the capabilities of the instruments which they are using.

In a general way they forget that one cannot get a good picture of an object that is between them and the sun, or on which the sun's rays fall directly vertical. Then they expect too much of a so-called "universal focus" lens, thinking that it will reach out sidewise so as to get both ends of a passenger car sixty feet long at a distance of twenty feet, and at the same time get the details of a ruined tower on a hillside half a mile or more away.

They also expect to get an undistorted picture of a tall building only forty feet away; and to get a good, sharp picture of a smutty black object like a locomotive just come in from a long run. Or, they will think that a moving object can be as readily "snap-shotted" from the top of a street car or omnibus going rapidly in the opposite direction as from a stationary location.

They also expect the same speed from a $5 lens as from one costing $50 or more; the same speed with a given shutter, no matter what kind of plate, or with the same plate, no matter what the shutter or the lens, or the same speed in Leipzig as in Naples or Cairo. Also, they will use the same developers and fixers with Thomas', Richard's or Henry's plates, and expect to get the same results; and the same way with papers. They will use the same baths with the celebrated X as with the renowned Y or the famous Z brand.

The best plan is to pick out some one good make of plate or film that can be got in photographic supply shops generally, and learn how to use it, first under only one set of controllable conditions (as lens, stops, baths, etc.) and then gradually work up to a full knowledge of the behavior of that kind of negative under various conditions which it is desirable to change. Sticking to one brand of negative leads to better results in the end than experimenting.

And now for the camera itself. We will say that it is a hand camera with a "pull-out" on which the distances are not marked for very near objects. If there is a ground glass plate on which to observe the image, set the instrument on table or tripod a given distance, as three feet from a wall which is well illuminated by direct sunlight and on which there is an ordinary placard with some letters as small as one-fourth of an inch in height, and pull out the "draw" until the letters appear sharp and clear. Then make a knife scratch so that that amount of pull-out can be found again when wanted, and mark it "3." Similarly mark the "4," "6," "8" and "10" positions.

Now tack up on the wall a two foot rule, or a yardstick, or other convenient measure, and for each position of the "draw" see what length can be distinctly seen. Thus we will say that at three feet only 15 inches can be seen the "short way" of the plate; at six feet, 36 inches, and so on. This will prevent miscalculations of distance and frequent disappointments when there is no time to change the position of the camera or of the object being photographed.

Where the camera has no ground glass plate, it may be feasible to substitute one temporarily for the film board or whatever else is about at that position. If no ground glass is available, tracing paper, or tracing cloth, or paraffined or oiled paper will answer quite well. If the substitution cannot be made, then perhaps the objective can be taken out and tested with a glass or paper screen at various focal distances, with objects at measured distances away. If all these methods fail, then mark on your poster a ring one foot or two in diameter, and take half a dozen or a dozen negatives at various distances from the poster and with various positions of the pull-out. You will thus learn the "sharp" positions of the pull-out for each distance from the object to be photographed and also the size circle within which you may work. Thus, if at a given distance you find that your two foot circle occupies half the short diameter of a 4×5 inch plate, you may rest assured that the maximum circle within which you may operate at that distance will be four feet in diameter; but you might also take in an object that was five feet one way if it was not more than four feet in the opposite dimension (provided, of course, that the long way of the plate came with the long way of the object).

It is also a good plan to practice with the various "stops" under various known conditions; and to test the finders, where there are any, to see if they are of the right size and in the right position, as they are very often hastily placed, and also sometimes get slid out of adjustment.

The Kick of a Rifle.

When a man gets a rifle for big game shooting, he sometimes forgets to consider one of the most important points—the kick—says the New York Sun. A gun which uses 70 grains of powder and 500 grains of lead caves a weak man's shoulder in and makes the flesh black and blue. If the man has more pluck than sense, he continues to use the big gun in spite of the discomfort, and thereby sometimes ruins himself as a shot.

When one of the big bore, big charge rifle cranks picks up a rifle and fires it at a target, alive or dead, a painful expression twists his face, and just as he pulls the trigger the butt, shoulder flinches from the recoil. That flinch is ruinous to the aim, and men often get so used to flinching that they dodge the kick of a 22 short cartridge as vigorously as they do a 50-110-500 one.

Men who flinch from their guns do not know it usually, until some time they are standing nicely balanced on a freshly peeled hemlock log, or some other slippery place, and the gun misses fire. The man flinches and his foot slips at that, and down he tumbles. Even then the chances are that he will not understand the reason of it.

What "Good Will" Means.

We frequently hear the term "good will" used in describing a benefit or advantage existing as a part of or in connection with a business, says an exchange. It is defined in several cases as the advantage or benefit which is acquired by an establishment beyond the mere value of the capital, stock, funds, or property employed therein, in consequence of the general public patronage and encouragement which it receives from constant or habitual customers on account of its local position, or common celebrity, or reputation for skill or affluence, or punctuality, from other accidental circumstances or necessities, or even from ancient partialities or prejudices. This is a definition given by Story and followed in several cases. Boiled down, this definition would seem to mean simply that the good will of a business consists in the probability that customers will continue to come to the old place of business. At best it is a sale of a mere chance, which vests in the purchaser nothing but the possibility that a preference which has usually been extended may continue.—The Keystone.

The Old Britannic Breaks Her Own Record.

A noteworthy feat was accomplished on the last voyage of the White Star liner Britannic from Liverpool to New York, when she crossed in 7 days 7 hours and 30 minutes. This was done with the identical boilers and old-fashioned compound engines which were put into the ship when she was launched by Messrs. Harland & Wolf, at Belfast, in 1874. That a ship should grow faster as she grows older bears testimony to the excellence of the work which was put into the early transatlantic liners. The performance was due, however, in part to the weather, which was exceptionally quiet. The calm which has settled upon the Eastern States during the recent hot wave has evidently extended across the Atlantic, and probably has been of unprecedented duration.

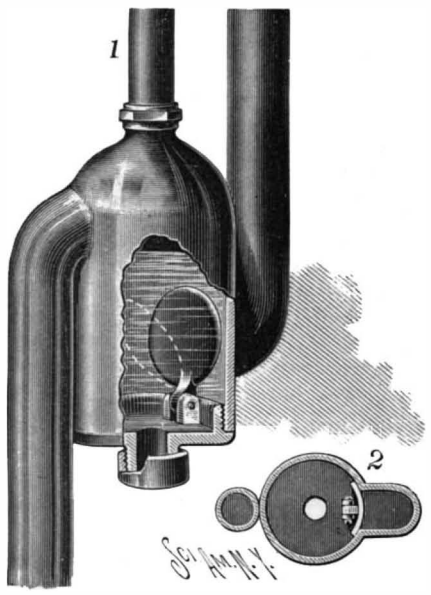
Another Record Trip by the St. Paul.

The sister ships of the American Line are cutting down the record time from Southampton to New York with each trip they make; the 6 days 2 hours and 24 minutes record of last week by the St. Louis being reduced to 6 days and 31 minutes by the St. Paul on her voyage ending Friday, the 14th inst. The average speed for the whole trip was 21·08 knots. When we bear in mind that the St. Paul was only designed for a sea speed of 20 knots this is a really splendid performance. She will undoubtedly cross within 6 days during this season.

© 1896 SCIENTIFIC AMERICAN, INC.

AN ACCESSIBLE SEWER GAS TRAP.

The improved trap shown in the illustration is designed to be perfectly proof against sewer gas and not liable to siphon, while being readily accessible for cleaning and other purposes. It has been patented by George J. Dehn, of Iron Mountain, Mich. Fig. 1 represents the trap in perspective, with a portion of its shell broken away to show the interior, and Fig. 2 is a sectional plan view where the inner valve is hinged. In the side of the trap body, below the inlet opening, a valve is pivoted on a clamping pivot held on a cap

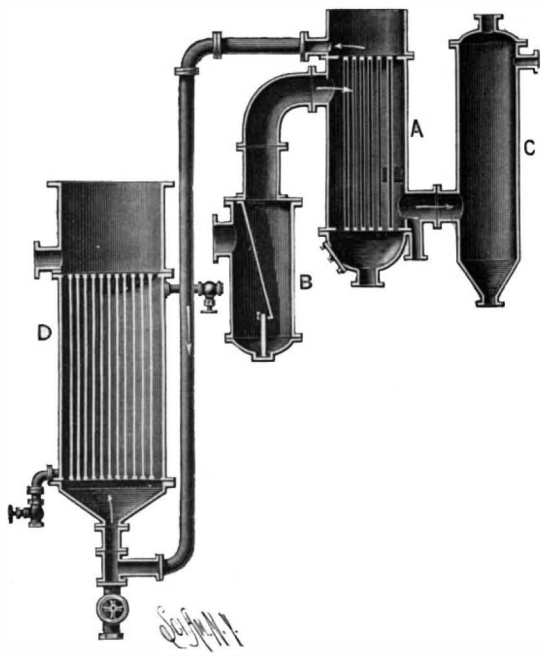


DEHN'S SEWER GAS TRAP.

screwing in the lower end of the body. The cap has an apertured and externally threaded lug, normally closed by a small cap, permitting the attachment to the bottom of the trap of a hose from a water main or force pump, to remove any stoppage in the outlet pipe. The upper end of the body of the trap is provided with a vent pipe, connected with the trap by a suitable coupling. By unscrewing the large cap any matter which may clog up the body of the trap is readily removed. When the small cap is removed, the valve is closed to prevent sewer gas from passing through the empty trap body and up the inlet pipe.

APPARATUS FOR TREATING JUICE AND VAPOR.

For condensing the vapors produced by evaporation in the vacuum pans of sugar processes, and economically heating and clarifying the juice, the apparatus shown in the accompanying illustration has been patented by Alphonse F. Gaiennie, of Lafourche (Thibodaux P. O.), La. The condenser, A, has a shell with upper and lower heads carrying pipes opening at their lower ends into a chamber connected with an inlet pipe bringing cane juice from the mill, the upper ends of the pipes discharging into a tank at the top. Near its upper end the condenser, A, is connected with a vapor pipe provided with a catch-all, B, the vapors thus passing from the vacuum process of evaporation, and surrounding the pipes, giving off the heat of the vapors to the juice flowing upward through the pipes. The vapors flow downward around the pipes and in a nearly condensed state pass through a pipe to a water condenser, C, to be finally condensed, their being in the pipe an outlet to carry off any condensed liquid. The juice passing upward through the pipes in the condenser, A, and accumulating in the tank at its top, passes from the latter into a chamber forming the lower end of a superheater, D, through which pass pipes whose upper ends open into a tank with an outlet pipe connected with settling tanks. The central shell of the superheater is connected with a suitable source of steam supply, whereby the juice passing upward through the pipes is heated. It is designed that the juice flowing upward through the condenser, A, will be heated up to about 130° to 140° Fah., to be in proper condition for additional heating in the superheater, D, while the vapors flowing downward around the pipes will have their temperature so lowered that they will readily condense in the water condenser, C, the whole process of condensing the vapors and heating and clarifying the juice being thus carried on in a very economical manner.



GAIENNIE'S JUICE AND VAPOR TREATING APPARATUS.

Surface Colors.

The object of the little book on this subject * by Dr. Walter, of Hamburg, is apparently to furnish zoologists, mineralogists, and chemists with an accurate explanation of certain color phenomena which are not as yet universally understood, and which are incompletely treated even in the best text books on physics. The keynote of the whole book is given in a single sentence of the introductory chapter: "The intensity of the light reflected from any body may be calculated by Fresnel's ordinary formulæ for colorless substances, in the case of those rays which are slightly or not at all absorbed by the body in question; but for wave lengths which are strongly absorbed by the given substance, Cauchy's formulæ for the intensity of metallic reflection should be used." It appears from these formulæ that the intensity of the reflected light depends on the index of refraction and on the coefficient of absorption of the substance presenting the reflecting surface. Since both these factors are different for light of different colors, it is shown that white light must be reflected with some of its "components" relatively weaker than others, i. e., no longer in the proper proportion to give the sensation of white light. The application to the colors seen in the mineral kingdom is illustrated by the example of magnesium cyanplatinite, $MgPt(CN)_4$, where—as is true of most crystals—the index of refraction and the coefficient of absorption vary with the direction in which the light vibrates, as well as with the wave length of the light. The extent to which true surface color is observable on minerals is not indicated, though the possibility of a very wide application is clearly shown. In the appendices, certain mathematical aspects of the subject are treated in a manner suited to the requirements of physicists.—The American Naturalist.

ACCIDENT TO DRY DOCK NO. 2—NEW YORK NAVY YARD.

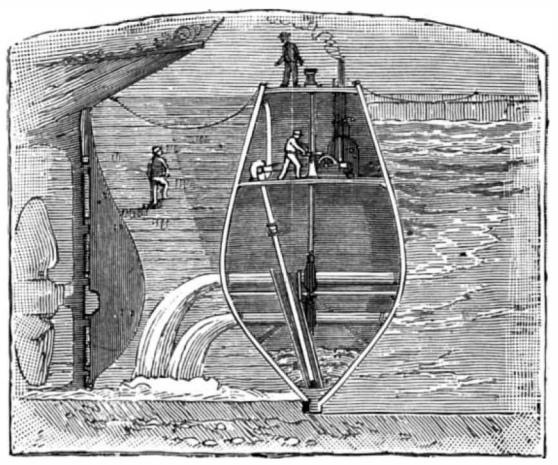
An accident to the great Simpson dry dock at the New York Navy Yard, Brooklyn, N. Y., occurred on the evening of August 8. The dry dock was pumped out and by some means the caisson, closing its mouth, was lifted from its seat so as to permit the entrance of water. As the water increased in depth, the caisson was lifted from its seat. The water madly rushed into the dock, carrying with it the caisson, which capsized and sank, and the torpedo boat Ericsson, which was badly injured, having its bows stove in. The commandant's launch was wrecked. Other vessels were nearly torn from their moorings and some minor damage was done. The accident, which was an unprecedented one, is attributed to the fact that the caisson was too light. It seems that a number of tons of ballast had been removed from it in order to permit the cleaning of its bottom, and this ballast it was proposed to replace by concrete ballast. It was supposed naturally that the caisson would stay in its place as the water pressed it against the gasket, but on account of an unusually high tide or other cause, the accident occurred.

We thought it of interest to our readers to give the annexed cuts to show what sort of structure the caisson is. It is to all intents and purposes a very deep narrow vessel, somewhat like a cutter. It is of such size as to fill the opening of the dry dock. It is prevented from entering it by its keel stem and stern post, which form a uniform flange around its bottom and sides, and which bear against a projecting piece at the mouth of the dock. A rubber gasket is attached to the face of the projection, so as to make a watertight joint as the caisson is pressed against it.

One illustration gives the cross section of the caisson and shows the method adopted to admit water when the dock is to be filled by means of pipes extending through the hull. This feature is also brought out in the illustration of the caisson in place at the opening of the dock where water is seen streaming through it. It is manipulated by flotation. When the dock is full of water, the caisson is lightened by pumping out water ballast. If in place closing the dock, it will rise from its seat, and can be pulled to one side. For replacing it is floated into position, ballasted down to its seat, and the water in the dock is pumped out.

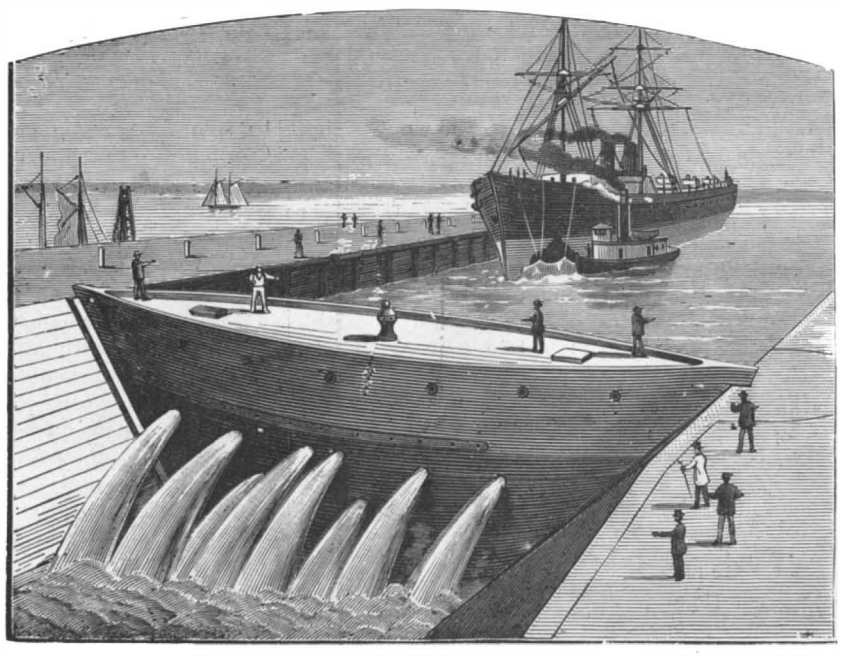
The dock in which the accident happened is known as Dry Dock No. 2 and is 500 feet long, with a top width of 130 feet and 4 inches.

In our issue of November 30, 1889, a somewhat extensive account is given of this dry dock, now thrown into uselessness at a period when much required. The accident necessitates sending large ships to the South for



SECTION OF THE CAISSON.

docking, because the stone dock of the Navy Yard is too short for large modern ships. The dock which is thrown out of use by the displacement of the caisson is built of timber, and a third dock, which we have also described in our columns, is now in course of construction on substantially the same plan.



CAISSON IN POSITION.

An Electric Scorer for Fencing.

Mr. Muirhead Little, F.R.C.S., a pupil of the veteran maitre d'armes M. Bertrand, has invented a very ingenious means of judging hits in fencing bouts. The machine was tested with great success at a competition between M. Bertrand's pupils at his spacious fencing room in Warwick Street. The end in view has been achieved by covering the front of each jacket with fine copper or brass wire gauze and connecting this with the adversary's foil and an electric bell (of the burglar alarm pattern) and battery in the same circuit. It follows that when a hit is made the circuit is closed and the bell rings and continues to ring until stopped by the person in charge. A special arrangement in each foil handle provides that only a direct point produces a ring. Two entirely electrically distinct circuits are used, each including a bell, foil, and jacket; flicks, or blows, or grazes produce no result. The bells being of different tones, and, moreover, placed on opposite sides of the room, there is no difficulty in deciding who has scored a hit, or in cases of almost simultaneous hits, who delivered the point first. By a very simple arrangement the wires passing from the batteries to the combatants' collars are kept well out the way, however sudden may be their movements of advance or retreat. The wires did not interfere in the least with the foil play of the competitors, who were scarcely conscious of the connection. Captain Hutton and other distinguished amateurs who were present expressed themselves as much pleased with the "electric umpire," an opinion which M. Bertrand, who has done so much for the encouragement of fencing, shares.

* Die Oberflachen oder Schillerfarben, von Dr. B. Walter, pp. viii + 122, Braunschweig, F. Vieweg und Sohn, 1895.

© 1896 SCIENTIFIC AMERICAN, INC.

EXPRESS PASSENGER ENGINE, NORTHEASTERN RAILWAY ENGLAND.

We are indebted to the courtesy of Mr. Wilson Worsdell, Locomotive Superintendent of the Northeastern Railway, England, for a photograph and details of the locomotive shown in the accompanying illustration. No. 1870 is the second locomotive of its class to be turned out of the company's shops, and it may be taken to represent the latest English ideas on the question of designing powerful locomotives to haul heavy trains at high speed.

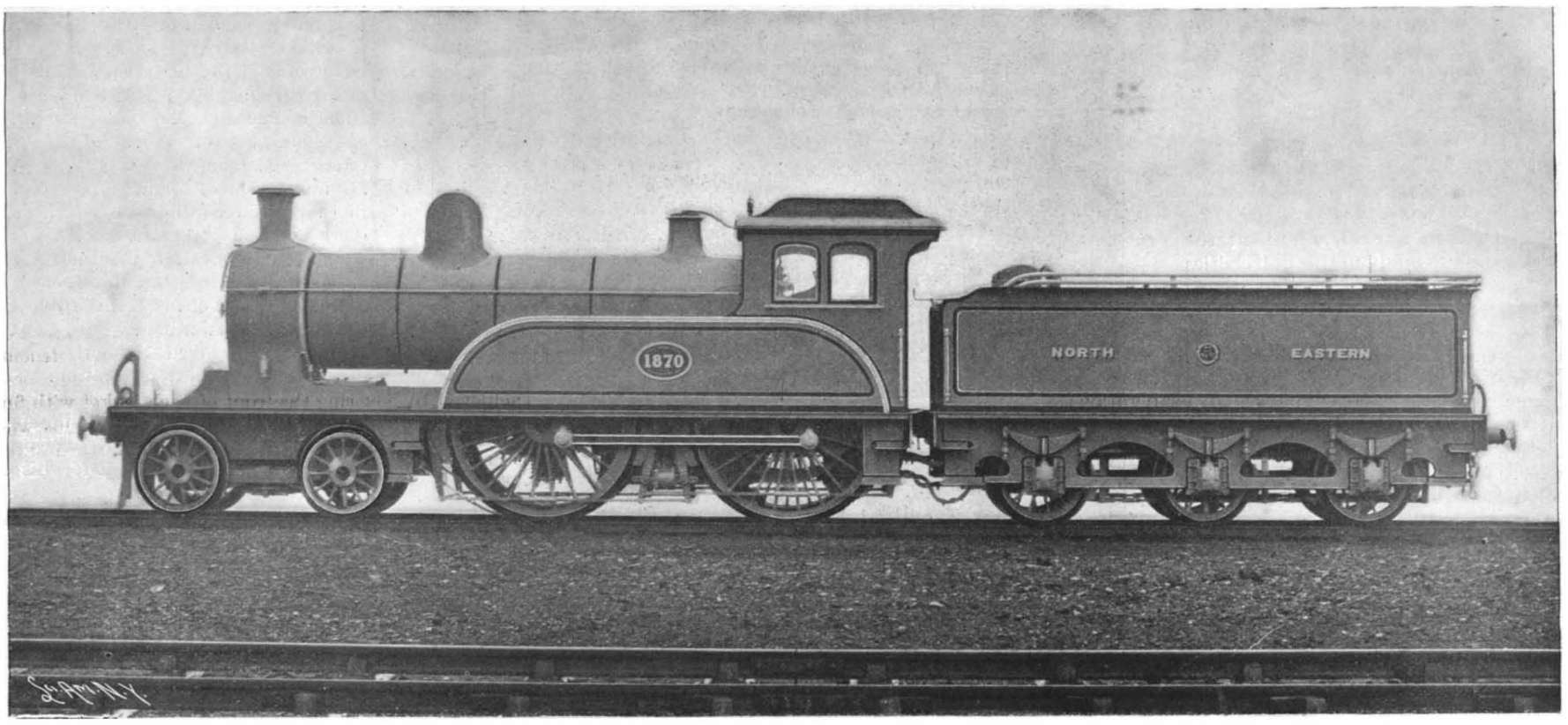
It must be admitted that within the limitations imposed by the English custom of placing the cylinders inside the frame, and hiding the working parts from view, which to American eyes always appears to rob a locomotive of much of its charm, this is a very handsome and well-proportioned machine, the general contour being harmonious and agreeable to the mechanical eye. A familiar feature will be recognized in the roomy cab, and particularly in the clerestory ventilator. Mr. Worsdell was the first English engineer to place a cab that was worthy the name upon his locomotives, and they have proved so popular that the engine drivers upon other lines are agitating to have the same common sense article placed upon their locomotives.

These fine engines present many features of interest. They were built under the spur of the keen competition which takes place between the East and West Coast routes from London to Scotland for the summer and autumn travel. This year the East Coast route has placed a new train of eight cars in service, which is built on the American plan, the cars being about 70 feet long, and weighing some 40 tons, the whole weight of the train being about 320 tons. This, it will be seen, is a very heavy load, as things have been going lately in record-breaking runs, and called for a locomotive of exceptional power. The result is seen in No. 1870, which is the largest and most powerful machine of its kind in England, and one of the most powerful in the world today, as will be seen from the comparative table below:

Dimensions.	C., B. & Q. 590.	N. Y., N. H. & H. 403.	C., R. I. & P. 1101.	N. Y. C. 999.	N. E. R., England, 1870.
Total weight	138,000 pounds.	131,000 pounds.	123,000 pounds.	124,000 pounds.	113,792 pounds.
Cylinders	19x26 inches.	20x24 inches.	19½x26 inches.	19x24 inches.	20x26 inches.
Weight on drivers	81,000 pounds.	86,000 pounds.	82,000 pounds.	84,000 pounds.	77,056 pounds.
Boiler type	Straight.	Extended wagon top.	Wagon top.	Wagon top.	Straight.
Boiler pressure	200 pounds.	190 pounds.	190 pounds.	190 pounds.	180 pounds.
Boiler diameter	58¾ inches.	62⅜ inches.	61 inches.	58 inches.	52 inches.
Number of tubes	210	312	260	268	201
Heating surface—firebox.	187·4 square feet.	167·52 square feet.	193·3 square feet.	232·92 square feet.	127 square feet.
Heating surface—tubes	1,392·7 square feet.	1,946·72 square feet.	1,795 square feet.	1,697·45 square feet.	1,089 square feet.
Heating surface—total	1,580·1 square feet.	2,114·24 square feet.	1,988·3 square feet.	1,930·37 square feet.	1,216 square feet.
Grate area	44·47 square feet.	30·22 square feet.	24·5 square feet.	30·7 square feet.	20·7 square feet.
Maximum travel of valve	6 inches.	6 inches.	6 inches.	5½ inches.	4⅝ inches.
Lap—outside	½ inch.	1⅛ inches.	1¼ inches.	1 inch.	1⅞ inches.
Drivers—diameter	84¼ inches.	73 inches.	78 inches.	86 inches.	91¼ inches.
Driving wheel base	7 feet 6 inches.	8 feet 6 inches.	8 feet 6 inches.	8 feet 6 inches.	9 feet 6 inches.
Tender, water capacity	4,000 gallons.	4,500 gallons.	4,300 gallons.	3,587 gallons.	4,000 gallons.
Tender—coal capacity	7 tons.	8½ tons.	7 tons.	6½ tons.	5¾ tons.

The comparison of No. 1870 is made with American in preference to English locomotives for the reason that this is the home of powerful express locomotives, and there is only one English express engine, the Great Northern single driver, which can compare with it in cylinder power. This has cylinders 19½ inch diameter by 28 inch stroke and an eight foot driving wheel. It is a noteworthy fact that in his latest design, Mr. Worsdell has forsaken the compound for the simple engine, and the single driver in favor of the four coupled. The latter type seems to have re-established itself as the best for hauling heavy loads at express speed, and we believe the powerful compounds of the Queen Empress type, designed by F. W. Webb, for the West Coast route, were seldom placed in front of the racing trains during last year's competition.

This tabular comparison between the latest American and English practice presents some strange anomalies. In the first place the lightest locomotive (English) has the largest cylinder capacity, and its load on drivers is the lightest; though this is somewhat compensated by the large drivers, 7 feet 7¼ inches. More striking, however, is the disparity between heating surface and cylinder capacity. The No. 403 of the N. Y., N. H. and H. Railroad has 2,114 square feet of heating surface for 20 by 24 inch cylinders; whereas the English engine, with larger cylinders, 20 by 26 inch, has only 1,216 square feet of heating surface, or not much more than half the amount. This is an extraordinary difference, and shows how widely divergent the practice of the two countries is to-day on this question of boiler capacity. The difference is to be explained in part by the superior quality of the English coal and by the higher conductivity of the copper fire box and brass tubes with which No. 1870 is fitted, and, furthermore, by the larger size of her driving wheels, which does not necessitate so frequent filling of the cylinders. But after all these deductions have been made there yet remains a large surplus of steam-producing power in favor of the American locomotive. If one were to venture a prediction regarding the Northeastern engines, it would be that they will be found to be over-cylindered. The driving wheels, 7 feet 7 inches in diameter, are the largest set of four coupled wheels in the world, and were only exceeded by some 8 foot 3 inch six-coupled wheels tried on the Continent some years ago.



EXPRESS PASSENGER ENGINE, NORTHEASTERN RAILWAY, ENGLAND.

Cylinders, 20 × 26 inches; driving wheels, 7 feet 7¼ inches; steam pressure, 180 pounds.

Lord Kelvin and His Notebook.

Lord Kelvin's power of abstraction from all surroundings, becoming dead to what is near him and lost in intellectual processes, is quite extraordinary, says Good Words. He is never without his "tablets," in the shape of a well-known notebook of the kind used by reporters, and which he carries in his pocket and produces at the most unexpected times. I have seen him, when on a visit to a country house, in a crowded drawing room, with all the jabber of conversation going on in full flood, sitting with his notebook and filling page after page with intricate calculations, seeking the solution of some problem which awaited investigation.

Lord Kelvin can do this in railway carriages, and in a storm at sea, as calmly as in his library. He will get himself propped up in the corner of his cabin and set to work, and become so absorbed as to be unconscious that there has been a gale blowing while he was at work. And yet, if recalled to ordinary life by some passing questioner, his gentle face lights up with interest, when others, more self-conscious than he, would display irritation. Indeed, I never knew a man less self-conscious. He is absolutely without affectation or any thought of self-importance. He will converse with a nobody in a manner so respectful and attentive as to make that nobody imagine himself that he has been delightfully interesting and even informing to Lord Kelvin. This arises from the simplicity and sweetness of a great nature.

The New Japanese Cathedral.

When foreign architects visit Japan and see the cathedral of Buddhism the first time, they are generally astonished at the magnificent structure. It is executed in pure Oriental style, and is richly ornamented with carvings. H. Ioto, a famous builder, of Nagova City, designed it. The structure was commenced in 1878, and was completed last year. The cost has been estimated at seventeen million dollars. It would have greatly exceeded this amount had not numbers of Buddhists worked without any recompense. As the structure neared completion, the committee having the work in charge was much perplexed as to fire insurance. They found that no company would assume the risk on such a valuable wooden structure, the danger of destruction by fire being very great, and thus the premium would amount to an enormous sum of money. At last the committee decided on a design devised by Dr. Tanabe. Numbers of powerful fountains were constructed, both exterior and interior, which can be made to play on all parts of the structure at the same time. Usually only one great ornamental fountain is playing, rising to the great height of 157 feet. This is probably the largest artificial fountain in existence, emitting 82,080 gallons per hour. In case of fire, all the water pressure can be directed through numbers of exterior and interior fountains, thus every part of the structure, both inside and outside, could soon be drenched and any conflagration soon extinguished.—Cincinnati Commercial Gazette.

Coal Consumption.

An industrious trifler, writing in a French review, has been at the pains to ascertain what is the annual consumption of coal on the railways and steam companies of the country, and he has worked out a total of 3,782,850 tons. This, he tells us, would make a pyramid 516 feet high and 894 feet at the basis, or nearly 70 feet above the height of the Great Pyramid. Then he goes on to calculate that if all this coal were loaded in trucks the train would be 1,625 miles, or—as with a nice feeling for the Franco-Russian alliance he puts it—the distance between Paris and St. Petersburg. If this train had to travel at the rate of 18½ miles an hour, it would take between 3 and 4 days to pass a given point. The railways of the whole world consume, he asserts, on the faith of statistics which are doubtless fairly accurate, nearly 63,000,000 tons of coal, which would make 25 "Great Pyramids," but he does not draw any moral from these figures except that a great deal of carbonic acid is thus precipitated into the atmosphere.—Westminster Gazette.

© 1896 SCIENTIFIC AMERICAN, INC.

EDWARD DRINKER COPE.

BY MARCUS BENJAMIN, PH.D.

American science honors its representatives by an election to the National Academy of Sciences or by an election to the presidency of the American Association for the Advancement of Science. This year the last-named organization is fortunate in having as its presiding officer a scientist who is also a member of the National Academy, for it was at its Springfield meeting last summer that Prof. Edward Drinker Cope, who ranks among the foremost of American paleontologists, was chosen to preside over its forthcoming Buffalo meeting.

Prof. Cope was born in Philadelphia, Pa., on July 28, 1840, of distinguished American ancestry. His great-grandfather was Caleb Cope, a Quaker of Lancaster, Pa., who protected the ill-fated Major André from a mob in 1775. His son, Thomas Pym Cope, whose line of ships made regular trips across the ocean, founded the great linen house in Philadelphia, which on his retirement passed into the hands of his sons Henry and Alfred, who then formed the well-known firm of Cope Brothers. Prof. Cope is the son of the younger of these two brothers.

His academic education was acquired at Westtown Academy and at the University of Pennsylvania, but he did not graduate, and turned his attention to science. He studied comparative anatomy in the Academy of Sciences, in Philadelphia, and in 1859 he joined the group of young naturalists who were associated together in the Smithsonian Institution under Prof. Baird. Their names are best recalled by the following stanza, improvised by one of their number, after a hotly contested argument on some disputed point in natural history:

Into this well of learning dip with spoon of Wood or Horn,
For students Meek and holy silver spoons should treat with scorn.

If Gabb should have the gift of Gill
(As Gill has gift of Gabb),
'Twould show a want of judgment still
To try to Cope with Meek.

Then he went abroad and spent the years 1863–64 in study in the universities of Europe, returning in 1864 to accept the chair of natural sciences in Haverford College, which he resigned three years later. Meanwhile he became paleontologist to the government geological surveys, serving at first under Hayden, on the survey of the Territories, and then under Wheeler, on the survey west of the 100th meridian. His work in this connection has resulted in the discovery of more than one thousand new species of extinct and as many recent vertebrata. There is not space here to consider these in detail, or, indeed, to even mention them, but, as has been well said, the titles of his papers, some four hundred in number, "form a systematic record of the development of paleontology in the United States." Of his larger works on this branch of science, most of which are contained in government reports, the following are the more important:

"Systematic Arrangement of the Lacertilia and Ophidia" (1864); "Primary Groups of the Batrachia Anura" (1865); "History of the Cetacea of the Eastern North American Coast" (1866); "Synopsis of the Extinct Cetacea of the United States" (1867–68); "Systematic Arrangement of the Extinct Batrachia, Reptilia, and Aves of North America" (1869–70); "Systematic Relations of the Fishes" (1871); "Systematic Relations of the Tailed Batrachia" (1872); "Extinct Vertebrata of the Eocene Formations of Wyoming" (1873); "Cretaceous Vertebrata of the West" (1877); "Tertiary Vertebrata" (1885); "Catalogue of the Batrachians and Reptiles of Central America and Mexico" (1887); "The Batrachia of North America" (1889); and he has just completed for the press "The Snakes and Lizards of North America," which will be issued by the Smithsonian Institution during the coming year.

Philadelphia has for many years been the home of Prof. Cope and, on the death of Prof. Joseph Leidy, in 1889, Prof. Cope was called to the vacant chair of geology in the University of Pennsylvania, which post he still fills. Besides the duties of his chair he has long been the senior editor of the American Naturalist.

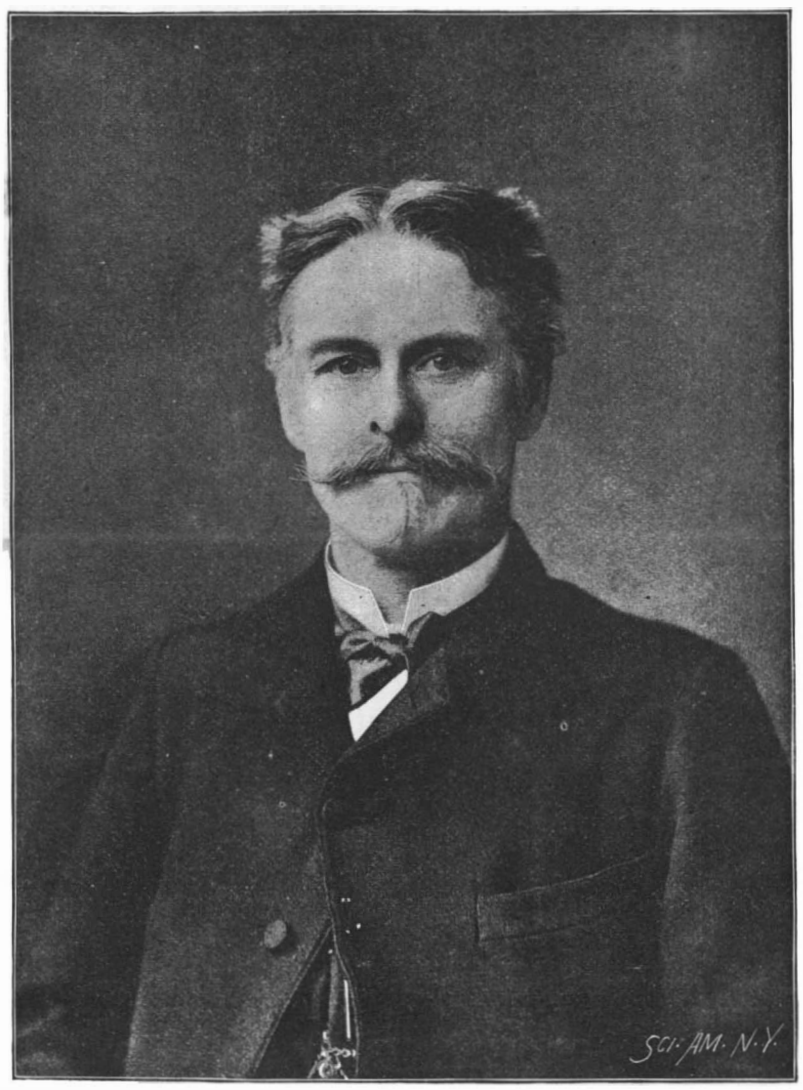
Prof. Cope is also well known as the graceful writer of numerous popular contributions in book form to the literature in favor of the now generally accepted doctrine of evolution. These include:

"On the Origin of Genera" (1868); "Hypothesis of Evolution, Physical and Metaphysical" (1870); "Method of Creation of Organic Types" (1871); "Evolution and its Consequences" (1872); "Consciousness in Evolution" (1875); "Relation of Man to Tertiary Mammalia" (1875); "On the Theory of Evolution" (1876); "The Origin of Will" (1877); "The Relation of Animal Motion to Animal Evolution" (1878); "A Review of the Modern Doctrine of Evolution" (1879); "Origin of Man and Other Vertebrates" (1885); "The Energy of Life Evolution and how it has Acted" (1885); "The Origin of the Fittest" (1886); and "The Primary Factors of Organic Evolution" (1896).

He is a formidable antagonist, and his strong pen was wielded relentlessly until the victory was won.

Honors have come to him. The Bigsby gold medal was conferred on him by the Geological Survey of Great Britain in 1879, and his name is on the rolls of many of the scientific societies in this country and abroad, including our own National Academy of Sciences, to which he was admitted in 1872.

He joined the American Association in 1868, and in 1875 was advanced to the grade of fellow. The section on biology made him its presiding officer in 1884, and in the following year he addressed the society on "Catagenesis." His name has frequently been urged upon the association for its highest office, but it was not until last year that the well merited honor came to him.



EDWARD DRINKER COPE.

The Discoverer of Zinc Etching.

But few of the readers of this journal [The American Art Printer] know that photo-zinc etching and photo-lithography, in so very many ways the same thing, were invented by two different men at almost the same time, the one being in England, the other nearly on the opposite side of the globe, in Melbourne, Australia. It was in the year 1859 that Mr. Osborn, of the Survey Department of Australia, sent a young man to England to confer with Sir Henry James about the new Australian method of reproducing and making printing plates for publication. Sir Henry James was surprised that the method was so very much like his own invention, which he made—nearly—by accident, and he showed the young man some very good prints, and told him the story of how he came to invent this great medium of modern reproduction.

According to a book on zinc etching, published in 1862, by A. D. C. Scott, Sir Henry James was visiting friends at Ryde, on the Isle of Wight, and made the acquaintance of a young lady artist who had great skill and talent in copper etching. She mentioned to Sir Henry James that it would be of great advantage to the public if there could be a way of producing art subjects in a cheaper manner than that of copper etching or steel engraving. That idea aroused in Sir Henry James the desire of finding some means of duplicating the etching made originally by the artist, so that prints might be obtained in quantity. After trying several methods of fixing a picture on a metal plate, he tried to make a print on chrome carbon paper, which process was used at that time (1859) in photography. He prepared the paper, printed a picture on it, then inked it in and developed it, and obtained a very nice copy, which he transferred to a sheet of zinc. He further prepared and etched it, and his pleasure knew no bounds at the satisfactory result he attained in etching his plate deep enough to print many thousand copies from it. He began to improve his method day by day, and in a short time he found himself overworked on reproducing old manuscripts and masterpieces of ancient art. Handwriting of Edward I and the great Doomsday Book, written in the year 1086, at Winchester, were among the first great works of reproduction by this invention. Day after day new treasures of art of long forgotten masters, authors, and celebrities came to light, and brought refinement and education to mankind.

A Great Historic Tablet.

Last winter I was permitted to excavate along a part of the ruin-strewn desert at Thebes, and to examine the sites of temples which stand there. On these few furlongs I found that there had been seven temples of the kings or the eighteenth and nineteenth dynasties, about 1450–1150 B.C. Most of these I entirely cleared out; the largest piece of all—the great buildings around the Rameseum—being the clearance of the Egyptian Research Account worked by Mr. Quibell. Each site gave us some return in information or objects; but the most valuable of the sites, as it proved, was one of the least inviting. A field of stone chips showed where the funeral temple of Merenptah had stood; and, left in the ruins, I found the great granite tablet bearing the long inscription of Merenptah about his Libyan war and his Syrian war, and naming Israel.

This tablet is over ten feet high, over five feet wide, and over a foot thick, of one flawless block of very fine grained granite, or, rather, syenite. It was first cut by one of the most sumptuous kings of Egypt, Amenhotep III; brilliantly polished as flat and glassy as a mirror, and engraved with a scene of the king offering to Amen, the god of Thebes, and an inscription of about three thousand hieroglyphs recording his offerings and glorifying the god. His son Akhenaten, who strove after a higher faith, erased all figures and inscriptions of Amen, and so effaced most of his father's fine carving on this great tablet. This, however, was all re-engraved by Seti I, about fifty years later, as a restoration. Then, some two centuries after it had been erected in the temple of Amenhotep III, Merenptah cast an envious gaze on the splendid stone, and stole it for his own purpose.

Not taking the trouble to rework it, he simply built the face of it into his own wall, and engraved on the comparatively rough back of the block. At the top he figured a scene of the king offering to Amen, and below an inscription very nearly as large as that of Amenhotep III on the other side. The painting of the sculptured figures still remains as fresh as on the day it was done; for, as the tablet fell face forward when the temple was destroyed, the side belonging to Merenptah lay downward, while that of Amenhotep III was uppermost. In the ruins, then, amid the fragments of columns and foundations, heaped over with a foot or two of stone chips, this grand block had lain since about the time of the Trojan war. All Greek history, Roman, and mediæval—the prophets, Christianity, and Islam—have swept along while this was waiting unsuspected, with its story of the wars of Pharaoh of the Hard Heart, and his crushing of Israel.—Prof. Flinders Petrie, in the Century.

Molybdenum Bronzes by Electrolysis.

Among the future products of electrolysis at high temperatures, it seems probable that useful alloys may find a place; at any rate, electro-metallurgists are demonstrating the possibility of preparing many new compounds, some of which may turn out to be of considerable industrial utility. In the Berichte, says the English Electrical Review, Stavenhagen and Engels describe some molybdenum bronzes which they have recently succeeded in preparing. Among these, there is one which bears a great resemblance to tungsten bronze, and is formed by electrolyzing fused acid, sodium molybdate. The fusion is performed in a platinum crucible, with a current of 8·5 amperes and generated by three accumulators (4·9 volts) placed in series. The bronze separates quickly at the cathode in crystals, which have to be washed with boiling water and dilute hydrochloric acid. It is soluble in alkalies, in nitric acid, and aqua regia, but not in hydrochloric or sulphuric acids; its composition is found by analysis to correspond to the formula, $N_2Mo_8O_{15}$. For further details consult the original paper in the Berichte der Deutschen Chemischen Gesellschaft, xxviii, page 2280.

© 1896 SCIENTIFIC AMERICAN, INC.

NANSEN'S POLAR EXPEDITION.

Advices from Vardoe, on the coast of Norway, in the Arctic Ocean, report the arrival there, on August 13, of Dr. Nansen, the Arctic explorer, who had left Vardoe on his last polar expedition on July 21, 1893. Dr. Nansen is accompanied by Lieut. Hansen, and the expedition is said to have reached two degrees and fifty minutes farther north than ever before attained, namely, 86 degrees 14 minutes.

Dr. Nansen says: "The Fram left Jugor Strait, August 4, 1893. We had to force our way through much ice along the Siberian coast. We discovered an island in the Kara Sea and a great number of islands along the coast to Cape Cheljuskin. In several places we found evidences of a glacial epoch, during which northern Siberia must have been covered by inland ice to a great extent. On September 15 we were off the mouth of the Clenek River, but we thought it was too late to go in there to fetch our dogs, as we would not risk losing a year. We passed the new Siberian Islands September 22. We made fast to a floe in latitude 78 degrees 50 minutes north and in longitude 133 degrees 37 minutes east. We then allowed the ship to be closed in by the ice.

"As anticipated, we gradually drifted north and northwest during the autumn and winter, from the constantly exposed and violent ice pressures, but the Fram surpassed our expectations, being superior to any strain. The temperature fell rapidly and was constantly low, with little variation for the whole winter. During weeks the mercury was frozen. The lowest temperature was 62 degrees below zero. Every man on board was in perfect health during the whole voyage. The electric light, generated by a windmill, fulfilled our expectations. The sea was up to ninety fathoms deep south of 79 degrees north, where the depth suddenly increased and was from 1,600 to 1,900 fathoms north of that latitude. The sea bottom was remarkably devoid of organic matter. During the whole drift I had good opportunities to take a series of scientific observations—meteorological, magnetic, astronomical and biological; soundings, deep sea temperatures, examinations for the salinity of the sea water, etc. Under the stratum of cold ice water covering the surface of the polar basin I soon discovered warmer and more saline water due to the Gulf stream, with temperature from 31 degrees to 33 degrees.

"We saw no land and no open water except narrow cracks in any direction. As anticipated, our drift northwestward was most rapid during the winter and spring, while the northerly winds stopped or drifted us backward during the summer.

"On June 18, 1894, we were on 81 degrees 52 minutes north, but we drifted then southward only. On October 21 we passed 82 degrees north. On Christmas Eve, 1894, latitude 83 degrees north was reached, and a few days later 83 degrees 24 minutes, the farthest north latitude previously reached by man. On January 4 and 5, 1895, the Fram was exposed to the most violent ice pressures we experienced. She was then firmly frozen in ice of more than thirty feet of measured thickness. This floe was overridden by great ice masses, which were pressed against the port side with irresistible force and threatened to bury, if not crush her. The necessary provisions with the cavas kayaks and other equipments had been placed in safety upon the ice. Every man was ready to leave the ship if necessary, and was prepared to continue with the drift, living on the floe. But the Fram proved even stronger than our trust in her."

Of his late experiences Dr. Nansen says, in another account:

"When the bear flesh was exhausted we were obliged to kill the weakest of the dogs to feed the others, and to continue so doing until the whole pack was slaughtered. If we had had dogs and canoes enough the pole would have been reached, but for lack of dogs we were compelled to turn back at latitude 86° 14'. I and my companions started in the direction of Spitzbergen May 19. After that we occupied six weeks on snow shoes, dragging after us sledges and kayaks (the Arctic canoe) loaded on sledges. We went partly over land and partly over sea ice. The land voyage was most arduous, but extremely valuable scientific results were obtained.

"Wherever we penetrated we found the ice broken. Large patches of water were also found 3,800 meters deep. Below the depth of 190 meters the water was

DR. NANSEN.

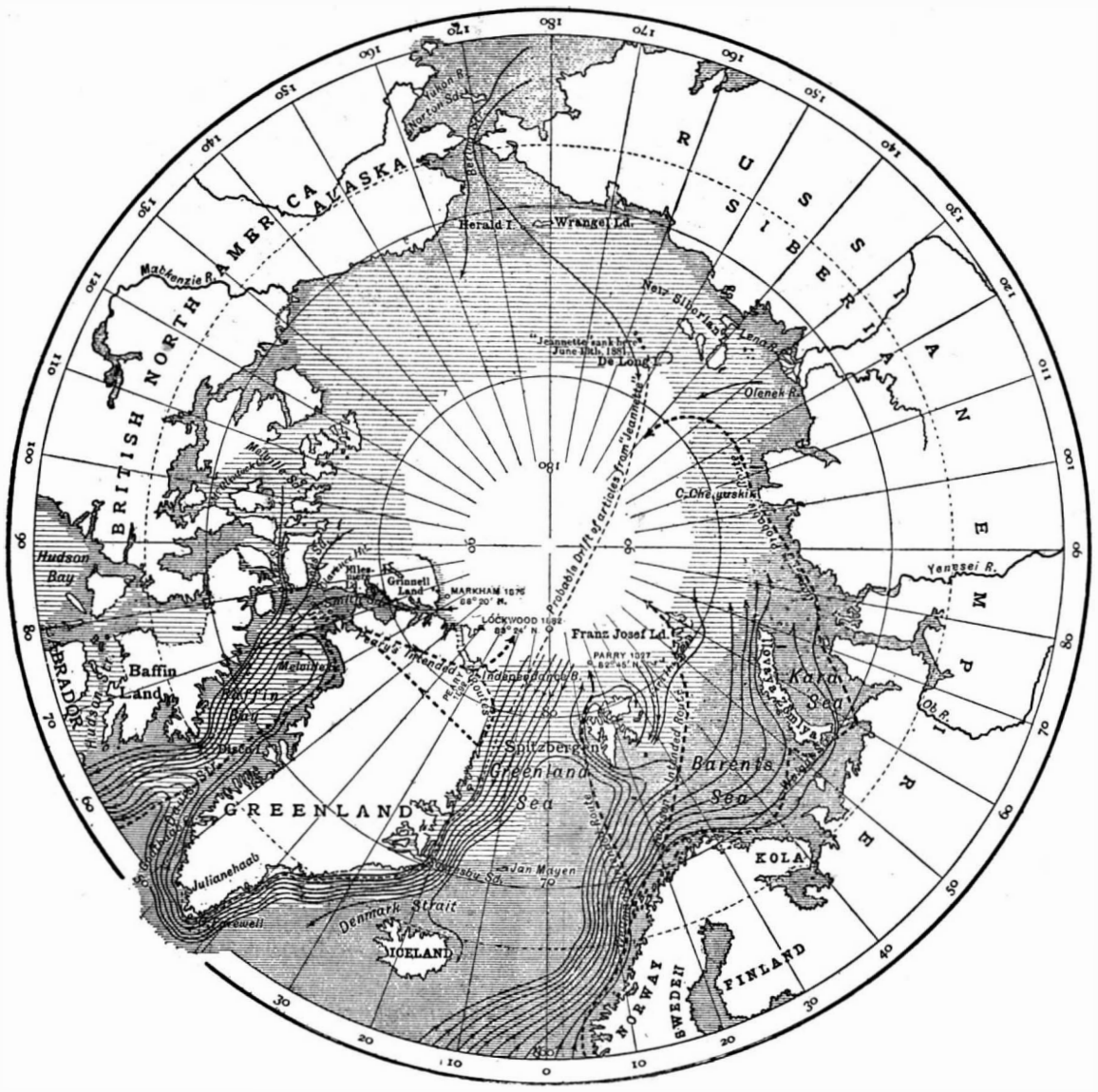
appreciably warmer, probably owing to the Gulf Stream. Rocky scars (precipitous cliffs) prevented entrance into the Olenek River for days. I left the Fram at latitude 84 in good condition and drifting westward, locked in the ice. I expect she will eventually reach Spitzbergen. In the autumn of 1895 I reached the north coast of Franz Josef Land and built a stone house, in which I lived the whole winter. The Jackson-Harmsworth expedition arrived at Franz Josef Land the following spring. I met Jackson in June on an ice floe off Cape Flora. I was surprised at the presence of explorers on Franz Josef Land, though I had been living for a long time in a hut quite close; it proved to be one of Jackson's stations. We went to Jackson's winter quarters, where we found all in good health. We remained there about six weeks till the steamer Windward arrived.

"The Windward will take to England four Englishmen of the Jackson-Harmsworth expedition—Child, Burgess, Fisher and Blomquist. Jackson proposes to remain in the Arctic regions until next summer, with the intention of pushing further north. Jackson and his companions are in excellent health and spirits, and full of hope as to the results of their expedition."

The theory on which Dr. Nansen's expedition was based was that ocean currents exist whose direction is from the islands of New Siberia across the North Polar region to Greenland, as indicated by the accompanying map, reproduced from the Geographical Journal, vol. ii. The Jeannette sank off these islands, and it was claimed that relics of the Jeannette were picked up on the shores of Greenland. Other drift relics were cited as additional proofs of these currents. In the face of this theory there were most emphatic denials, not only of the existence of such currents, but even of the authenticity of the finding of the relics.

Basing his expedition on this theory, Dr. Nansen had a special ship built for his trip, the Fram. She was a three masted schooner in rig, with engine and screw, rather of the auxiliary type. With a consumption of 2¾ tons of coal a day the Fram would develop a speed of six miles an hour, the idea being to use sail whenever possible and economize coal for use in emergencies. She was built with a very round bottom and her keel came even with the outer planking, so that nothing was presented for the ice to take hold of. The hopes were that if caught between opposing floes she would be lifted up bodily, the ice sliding in under her sloping sides and bottom. She was very strongly built, being planked with double layers of oak 3¼ inches and 4½ inches thick, sheathed again with ice planking varying from 3¼ inches to 6½ thick. The ceiling was in alternate strakes 4½ inches and 8½ inches thick. The enormous mass of timber for so small a vessel, in conjunction with her shape, seemed enough to make her stand anything. The screw and rudder were arranged so that they could be raised into a well for protection if desired. The ship was 101 feet 6 inches long, displacing 800 tons at 15 feet 6 inches draught with 3 feet 3 inches freeboard. Her carrying capacity was put at 380 tons and she carried five years' supply of provisions.

Her crew consisted of eleven men in addition to Dr. Nansen, and they departed prepared for an absence of three to five years. The ship was to coast along the northern shores of Europe until she reached the vicinity of the New Siberian Islands; here she was to strike north, depending largely on ocean currents to carry her along. The course would carry her past the North Cape and then approximately along the 70th and 80th circles of latitude until at or about the 150th parallel of longitude east from Greenwich, and just north of Bennett Island, the course would be changed to the north. Hence the explorer hoped to pass by the pole, to work down along the east coast of Greenland and thence to the east back to Christiansand.



NORTH POLAR MAP TO ILLUSTRATE POLAR EXPEDITIONS.

Remedy for Flies on Cattle.

Take coal tar two parts and coal oil and grease one part each and mix with a small amount of carbolic acid. Apply with a cloth by moistening the hair and horns of the animal with the liquid. In the applications include feet and legs, and it will drive every fly away, and one application will last ten days or more in dry weather. Apply as often as necessary and your cows will be entirely secure from flies of all kinds. Any kind of old lard or grease can be used. Coal tar is the base of this remedy, and when too thick to spread well, use more coal oil; when too thin to adhere well, use more coal tar. Carbolic acid will cost about 50 or 60 cents in crystals by the pound, and every farmer should always keep it on hand, as it, in its many uses, is indispensable. This remedy is equally effective as a lice exterminator on poultry, and is used simply by painting the sides of the hennery and roosts and dropping boards with the liquid. For young chickens saturate a cloth and place in the bottom of a box, and place the mother and young chickens in the box for an hour or so. This recipe, says H. F. Work, in the Drainage Journal, is equal to any preparation in the market.

M. MOISSAN has been experimenting with vanadium in the electric furnace. He finds that it alloys readily with iron, copper, and aluminum, and that its carbide VC is not affected by water at ordinary temperatures.

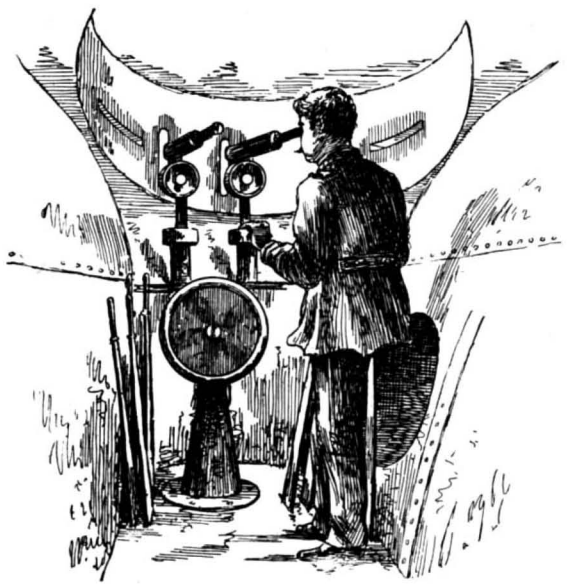
© 1896 SCIENTIFIC AMERICAN, INC.

THE FIRST CLASS BATTLESHIP INDIANA.

In our last issue are described in detail the defensive arrangements of the Indiana—her double bottom, side and deck armor, and massive turrets, by means of which she will be able to endure the awful storm of projectiles which will fall upon a modern warship in time of battle. This armor is as thick, and in most cases thicker than that of the best modern battleships of foreign navies, and, moreover, it is of far better quality, having been forged by the famous Harvey process, which was fortunately invented in time to be used on these ships. Judged by her mere power to resist penetration, there is no battleship in the world to-day that could stand attack by such heavy guns, or stand it so long, as the Indiana.

But a battleship is essentially a fighting machine, and her first requirement is that she shall be able to deliver heavy blows, and many of them. Unlike the cruiser, she is not designed on the understanding that she may frequently have to run from a more powerful ship. Her place is always in the thick of the fight; and when the designer has given her sufficient structural and armored protection to enable her to take her place in the first line of battle, his next object is to arm her with as many armor piercing and rapid fire guns as the limits of her displacement will allow. Judged by this double standard, the Indiana is without a rival; for it is a fact, which has never been disputed, that she carries the heaviest armament of any ship afloat to-day. This preponderance of power is due to the eight 8 inch guns which are carried in four turrets flanking the two turrets of the 13 inch guns. They are an entirely novel feature in battleship design, and may be called the chief distinctive feature of this ship. The accepted type of battleship carries usually a main battery of four heavy guns disposed in two turrets, fore and aft, supplemented by a broadside secondary battery of five or six inch guns, the first being capable of piercing armor and the latter being used against the lightly armored or unarmored portions of the enemy. Thus the Camperdown, of the British navy, a ship of the same size as the Indiana, and less effectively protected, carries four 67 ton guns of about the same power as the heavy guns of the American ship, and a secondary battery of six 6 inch guns. Against this the Indiana carries, in addition to her main and secondary batteries, the eight 8-inch armor piercing guns above mentioned — a preponderance of power which would give her the certain victory in a naval duel.

Our illustrations in this number are devoted to the armament of the Indiana, and show the methods of mounting and handling the great guns. This, especially in the case of the 13 inch guns, each of which weighs 67 tons, is a matter calling for great skill in design; and so well has it been carried out, that one man is able to raise or lower these great masses of metal, and swing them through an arc of 270 degrees, by the manipulation of a few small handwheels and levers situated within the sighting station of the turret. The gun itself is mounted in a gun metal seating, to which it is strapped down by the four steel bands shown in the illustration. The seating is arranged to slide, in much the same way as the rest of a lathe upon its bed, upon the upper flanges of a massive steel frame, the forward end of which is hinged to the wall of the turret, the after end being carried by the plunger of a hydraulic ram, by means of which the gun with its carriage is raised or lowered to give the proper elevation. The guns are trained by turning the turret which carries them. This is effected by hydraulic engines located within the shelter of the barbettes, below the turret, operating a pinion, which engages a circular vertical rack bolted to the inside of the turret. To check the recoil of the guns, which represents an initial energy of over 33,000 foot tons, a recoil cylinder is mounted within



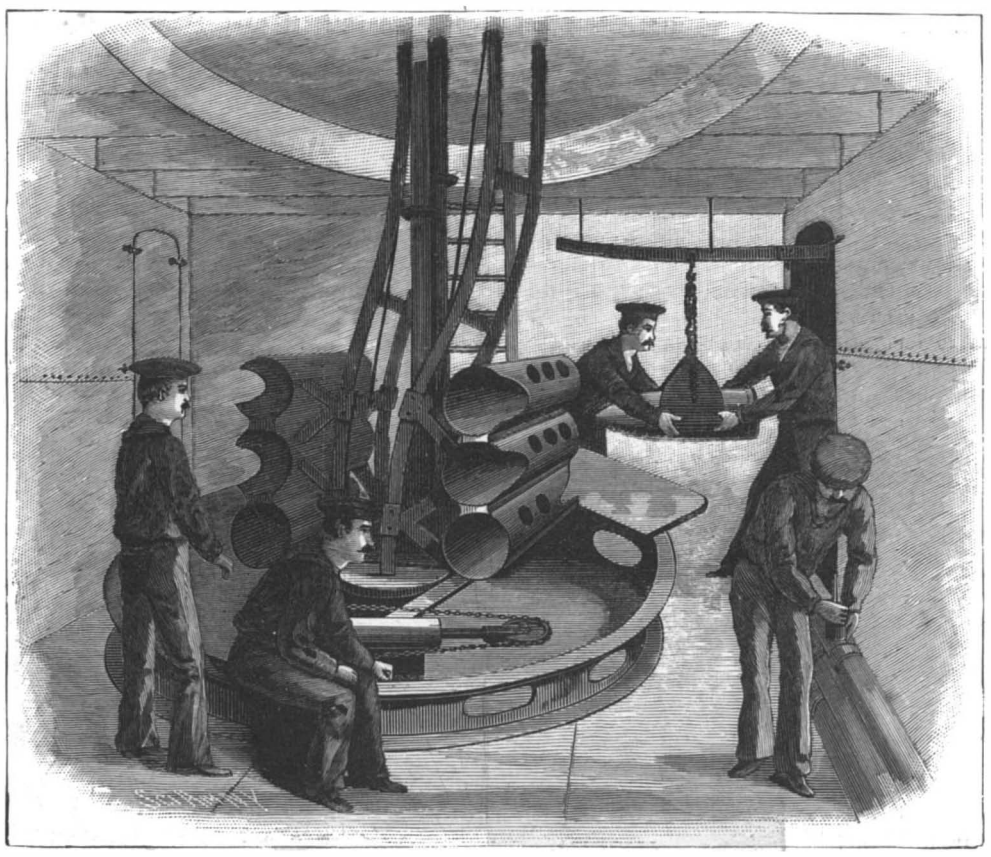
INTERIOR OF SIGHTING HOOD OF 13 INCH GUN TURRETS.

the gun carriage beneath the gun. It is filled with water, and is provided with a relief valve, which is automatically opened on the discharge of the gun. The plunger or piston is attached to the seating of the gun, and as the gun recoils the water is forced out of the cylinder, the brake action being secured by the small size of the discharge valve. After being loaded the gun is run out to the firing position by admitting water under pressure at the back of the piston in the recoil cylinders.

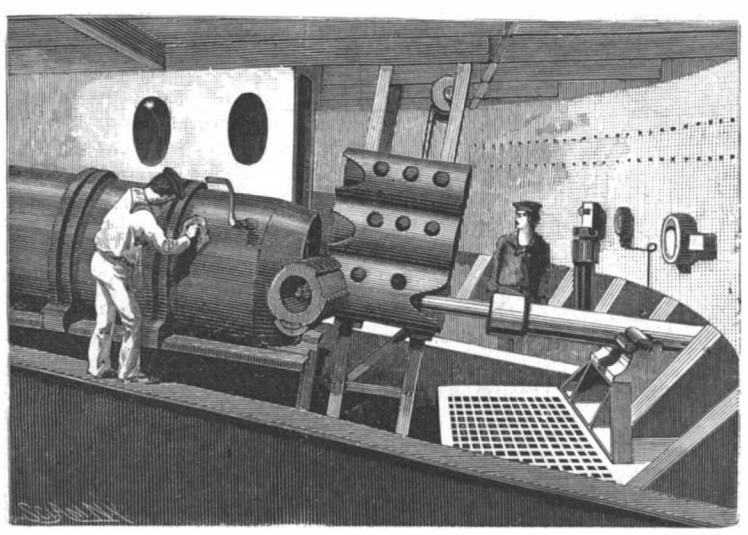
In describing the process of loading and firing a 13 inch gun, it is necessary to descend below the steel protective deck to the "handling room," which is located immediately beneath the turret. It is square in form, and at each corner is a watertight door which leads to the ammunition rooms, where the powder and shell are stored in suitable racks. The charge is transferred to a cradle suspended from an overhead track and run out into the handling room, where it is unloaded into the ammunition hoists, of which there are two, one to each gun. Each hoist consists of a triple cage of three hollow cylinders, the upper two for the powder, which is done up in two sections, and the lower for the shell.

The two sections of powder weigh 550 pounds, and the shell 1,100 pounds. The cage is then run up to the breech of the gun by a hydraulic ram and steel wire ropes and pulleys, the speed of the hoist being six times that of the ram. When the shell is opposite the breech it is rammed into the gun by a telescopic hydraulic rammer, which can be seen pivoted against the turret to the rear of the gun, the rammer being swung back against the turret wall when not in use. The two sections of powder are then rammed in after the shot, the breech plug, which is shown swung to the left clear of the gun, is thrust into the breech and locked, the firing attachment is screwed onto the stud, shown within the plug, and the gun is ready for the gunner to lay and fire. The breech plug and the mechanism for opening and closing it are very ingeniously designed, and will bear a detailed description. To enable the plug to withstand the shock of discharge, which is as great against the plug as it is against the shell, it is provided with a powerful thread and screwed into the breech of the gun. After the thread has been cut in the lathe, three wide channels are cut across it, parallel to the axis of the plug, similar channels being cut across the thread in the breech. When the plug is inserted, it is placed so that the remaining thread on both plug and breech will enter the corresponding channels. After it is driven home the plug is given one-sixth of a turn, thereby bringing the threads into engagement and locking the breech. There is a great variety of breech mechanisms employed in different navies, and some of them are extremely complicated. The system in use on the Indiana is a recent design and a great advance upon previous methods. The three operations of unlocking the plug, withdrawing it upon the swinging tray, and throwing the tray round clear of the breech are performed by one man, by means of a crank shown on the right side of the gun. The first motions of the crank turn a gear which engages a rack on the periphery of the plug and gives it a one-sixth turn, thereby disengaging the threads; the crank shaft then operates a screw, which thrusts the plug out upon the tray; and when this operation is complete another gear is engaged which swings the tray upon its hinges.

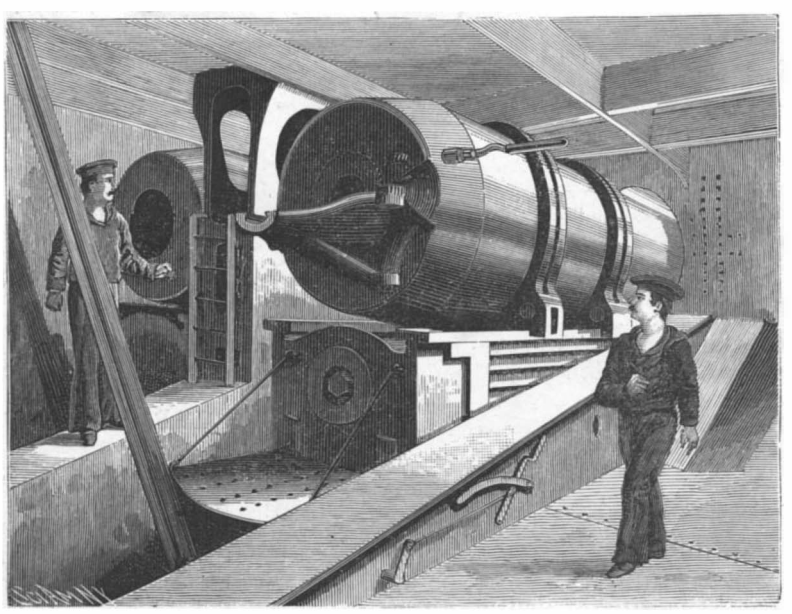
In the illustration showing the breech of the 13 inch guns will be noticed a ladder leading up to a plated, box-like structure. This latter is the position occupied by the officer who lays and fires the guns. The top of the compartment projects above the roof of the turret, and is heavily armored. It is provided with two narrow vertical and horizontal slots at which two sighting telescopes are placed, one for each gun. The axis of each telescope is parallel to the axis of the gun which it represents, and the handwheels which operate the telescopes at the same time serve to work the hydraulic rams for raising and lowering the guns, so that the two



THE BATTLESHIP INDIANA — LOADING THE AMMUNITION HOISTS FOR 13 INCH GUNS.

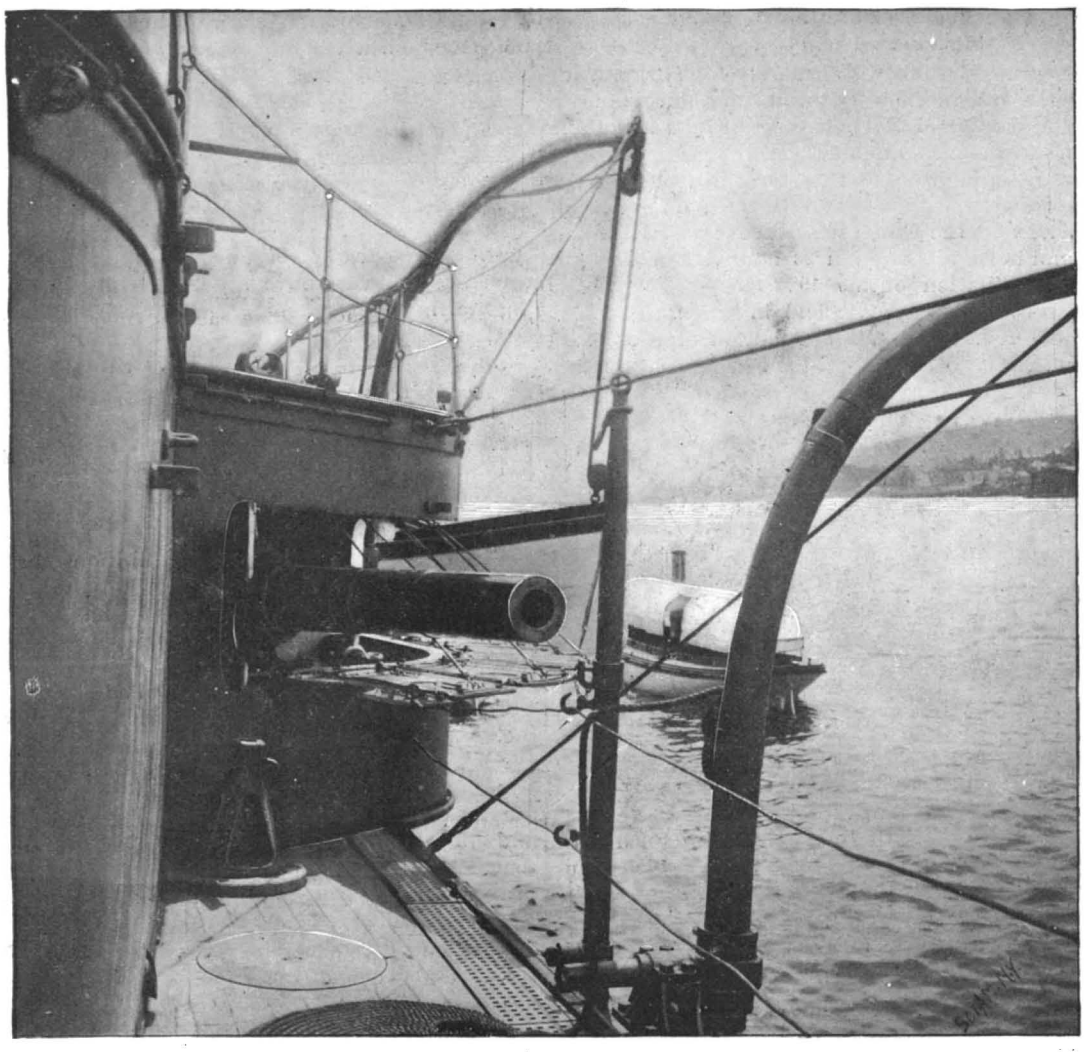


RAMMING HOME THE CHARGE IN A 13 INCH GUN.



BREECH OF THE 13 INCH GUNS.

© 1896 SCIENTIFIC AMERICAN, INC.



EXTERIOR VIEW OF 6 INCH GUN AND TURRET.

are adjusted simultaneously. The turning gear of the turret is set in motion by means of the vertical wheel shown in front of the gunner. When the sights coincide with the object, the gun is fired by means of an electric button placed conveniently to hand.

Flanking the main turrets are the four 8 inch gun turrets, whose interior arrangements are very similar to those above described. These guns are carried at a great height above water—no less than 26 feet—and they would, therefore, be well out of reach of the heavier seas in stormy weather. This great command is a valuable feature in a sea fight—command in a gun being like length of reach in a boxer. The shell being delivered from so great a height would have a "plunging" effect, and would also be less liable to be deflected by striking the tops of the waves. The four 6 inch guns are mounted below the 8 inch gun turrets, and on the main deck. The training is effected by means of a pinion and a circular rack, laid on the deck, both of which can be seen in the accompanying illustration. The elevation of the gun is accomplished by the worm and pinion, which meshes into a vertical, circular rack, which can be seen attached to the gun.

Our last illustration shows a part of the broadside rapid fire 6 pounder battery and the hinged grated shelves on which the gunners stand, the shelves hanging down vertically when not in use. There are twenty of these effective little guns in all. They fire a 2¼ inch shell which is capable of penetrating over 3 inches of iron at a distance of 1,000 yards, and as each can deliver some twenty shots a minute, it can be seen that a torpedo boat would be roughly handled, and probably disabled, long before she could get near enough to discharge her torpedoes. There are also six 1 pounder guns placed in the tops and on the superstructure. The weight, penetration, etc., of the guns is as follows:

Caliber	13 inch.	8 inch.	6 inch.	6 pounder	1 pounder
Length	40 feet	25⅓ feet	21¼ feet	8 feet	3½ feet
Weight	135,000 lb.	29,300 lb.	13,440 lb.	800 lb.	79 lb.
Perforation of wrgt. iron at muzzle	34·6 in.	20·6 in.	15·6 in.	4·4 in.	2 in.
Velocity at muzzle	2,100 f. s.	2,080 f. s.	2,150 f. s.	1,940 f. s.	1,460 f. s.
Weight of shell	1,100 lb.	250 lb.	100 lb.	6 lb.	1 lb.
Weight of charge	550 lb.	115 lb.	50 lb.	2 lb.	.....

Exposition at Brussels in 1897.

The Department of State has received an invitation, through the Belgian minister, for the participation by the United States in the International Exposition to be held at Brussels, beginning April 24 and closing November 1, 1897, and the Secretary of State, in a letter to the Secretary of the Treasury, has recommended that Congress be asked to appropriate the sum of $35,000 to enable this country to be properly represented by a commission. Attention is called to the fact that the Belgian government participated officially at the Chicago Exposition in the most liberal manner, and the opinion is expressed that the industrial and commercial interests of the United States would be greatly promoted by a creditable exhibit. "Although," it is added, "the great bulk of our exports to Belgium consist of raw products and food supplies, a considerable quantity—between $2,000,000 and $3,000,000 worth—of manufactured goods is purchased annually by that country from the United States, and the fact that, notwithstanding her great industrial development, Belgium imports largely of the finished products of other advanced manufacturing countries such as France and England, encourages the hope that similar lines of goods from the United States may find a much larger sale in Belgian markets. As conducive to that result, a proper representation of this country at the Brussels exhibition is obviously most desirable."

In his note transmitting the invitation, the Belgian minister states that the exposition will be under the patronage of his government, the Province of Brabant, and the city of Brussels. The object of the exposition is "to show the progress of industry, to invite the producers to various competitive contests, and to reward the winners."

There will be fourteen sections, namely, (1) fine arts, (2) social economy, (3) hygiene, (4) life saving, (5) industrial and decorative arts, (6) lighting, heating, and their devices, (7) electricity, traction, (8) military science, (9) manufactures, raw materials, methods of manufacture and their products, (10) sporting articles, (11 athletics and popular games, (12) temporary agricultural and horticultural competitions, (13) practical teaching, female industries, and manual work, (14) commerce, colonies. The divisions of the international competitions will represent a series of special exhibitions each of which will be reserved for objects of the same category. In each of the subdivisions there will be competitive contests relating to the problem the solution of which constitutes a requirement for the group entering each competition. Awards in money will be granted for the solution of the problems.

In addition to these competitions, there will be held by the organization of the foreign sections an exposition at which the different countries may freely exhibit their products.

The government has appropriated for the use of the exposition the park of Cinquantenaire, with its museums and annexes. His majesty the king, desirous on his part to testify his interest in this enterprise, has placed at the disposition of the exposition the royal domain of Tervueren. The productions of the Independent State of the Congo, the games that are the subject of section 11, as well as various other attractions, will be placed on exhibition there.

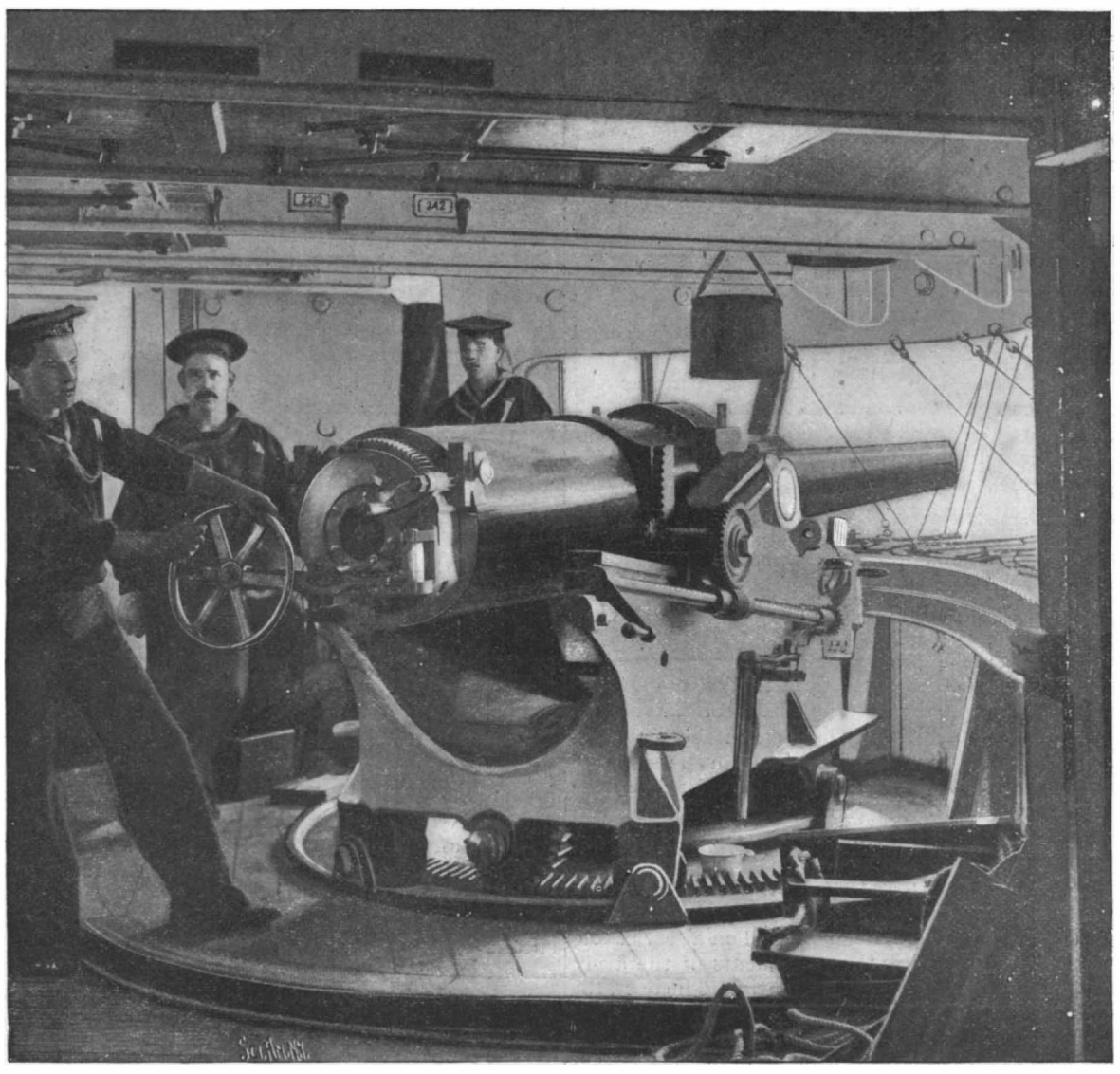
The park of Cinquantenaire will be connected with the royal domain of Tervueren by means of electric cars running through a new avenue, which, from its vast dimensions and picturesque situations, will form one of the most beautiful thoroughfares of the capital.

Lamalou-l'Ancien.

The last issue of the SUPPLEMENT, No. 1076, contains a very interesting account of the thermal baths at Lamalou, in the south of France, and the remarkable results derived from the treatment there of rheumatism, nervous affections, diseases of the spinal marrow, paralysis, and especially locomotor ataxia. The baths, though but little known in this country, are among the oldest in Europe, and to Dr. Belugou, the well-known physician of Paris and Lamalou, we are indebted for the description of the place and its waters.

A Gas Exhibition.

It is announced that a gas exhibition will be held in Madison Square Garden, New York City, probably some time in January, 1897. It is expected that every class of article necessary to the production and utilization of gas will find a place in the gas exhibition. For full particulars, address E. C. Brown, 280 Broadway, New York City.



THE BATTLESHIP INDIANA—TRAINING A 6 INCH GUN.

© 1896 SCIENTIFIC AMERICAN, INC.

Science Notes.

Magellan's contrary winds are to be overcome by a fleet of powerful tugboats which a Chilean company will maintain in the Straits.

The total area of land surface of the earth is calculated to be 28·3 per cent, and that of sea as 71·7 of the earth's surface, certain assumptions being made for the unknown polar regions. The ratio of land to water surface is thus 1 : 2·54, by Professor Hermann Wagner, says The Engineer. Other interesting levels are those of the mean height of the land, 700 meters—2,300 feet—above actual sea level; and of the condensation spheroid, i. e., the physical globe if the water were condensed to the density of the rocks of the crust, 1,300 meters—or 4,260 feet—below present sea level.

An interesting series of experiments on the transparency of liquids is described by M. W. Spring in the Bulletin of the Royal Academy of Belgium. The first of M. Spring's papers deals with the colors of the alcohols as compared with water. None of the alcohols observed were colorless when the thickness of fluid was 26 meters; methyl alcohol appeared greenish blue, ethyl alcohol the same, but of a less warm color, and amyl alcohol greenish yellow. The pure blue color observed in water becomes thus modified by the admixture of more and more yellow as we pass from one term of the homologous series of compounds to the next. The absorbing powers of the various liquids for ordinary light were also observed, and it was found that these formed a descending series, the simplest substance, water, offering the greatest resistance to the passage of light seen by the eye. In a second contribution, the same writer discusses the temperature at which the connection currents begin to produce opacity in a column of water of given length. Where the length is 26 meters the smallest difference of temperature that will suffice is about 0·570°, and is comparable with that which doubtless exists in lakes and seas. The author concludes that we have here an explanation of the varied colors so often seen on water. These result from the differences of temperature caused by sunshine, on the one hand, and by the cooling action of wind blowing on the surface, on the other.

Cycle Notes.

A pneumatic tricycle hearse has been built.

One French maker is putting out wheels equipped with wooden spokes, rims, and hubs.

A subscription agent of Business goes over large sections of the country, wheeling from place to place.

A short time ago a race was run in Paris in which no machine was entered which was not at least twenty years old.

In Grand Rapids, Mich., a trailer for the free transportation of passengers' wheels is run once an hour, attached to a trolley car.

A coin controlled bicycle has been devised. Unless the machine is fed with coins commensurate with the time of hiring, the wheel will refuse to turn.

An analysis of two thousand accident policies, on which benefits were paid, showed that only seventy-six were injured in bicycle accidents.

It has been estimated that the expenditure of power necessary to walk five miles would drive a bicycle on an ordinary road twenty-five miles.

Fifty bicycles were impounded in one day in Paris recently because they failed to have the owner's name and residence soldered to them as the law requires.

An agency was recently opened in Venice for the rental of a water cycle. The gondoliers promptly obtained an injunction restraining the parties from placing their cycles in use.

At some of the stations on the Long Island Railroad facilities have been provided for checking the wheels of the suburban residents, so that they can use the bicycle to carry them to and from their homes.

A good wrinkle in putting a handle on a handle bar is to smear a little vaseline around the edge of the inside ferrule, which will effectually prevent the cement from adhering to the ferrule, should any be squeezed out.

Zigzag hill climbing is easier than the straight lift. The cyclist can here learn of the mule. No mule native to a mountainous region takes a straight course up hill with a load, but "weaves" continually from one side of the way to the other.

Although very often but little attention is given to the accurate adjustment of the head, this part stands in need of it as much as any bearing in the machine, and should never be allowed to remain in the slightest degree loose. Not only will a loose head rattle over rough ground, and cause the balls and ball races to wear unevenly, but the risk of a breakage of the steering post or front forks is increased.

The Inventive Age says that the latest invention to facilitate field operations is the typewriter bicycle. This consists of a typewriter mounted on a serviceable wheel, which can follow the movements of the army through an ordinary stretch of country. The operator can take commands and general orders in shorthand and strike off several duplicates on the typewriter, being held erect by portable props. It has been tried in England and worked very satisfactorily.

THE BROOKS PERIODICAL COMET.

WILLIAM R. BROOKS, M.A., F.R.A.S.

The return to visibility, after its seven years' journey around the sun, of the very interesting comet known as the Brooks periodical comet of 1889, is a notable event in astronomical annals.

While sweeping the southeastern heavens on the early morning of July 6, 1889, with the ten inch equatorial telescope, the comet was discovered. It was in Cetus, and in right ascension 23 hours, 44 minutes, 30 seconds; declination south 9° 10′.

Fig. 1 shows the telescopic field in which the comet was discovered. The apparent motion of the comet was from right to left, as we look at the figure, but

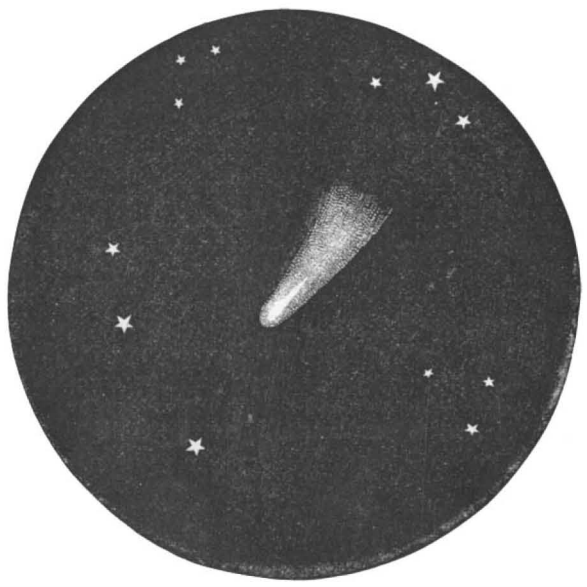


Fig. 1.—DISCOVERY TELESCOPIC FIELD BROOKS' PERIODICAL COMET.*

this motion was so slow that it did not move out of the telescopic field of discovery for over a week. The real motion of the comet was nearly in the line of sight, and approaching us and the sun. Hence the comet grew larger and brighter daily. As it came nearer, the main comet was found to be attended by several companions.

In telescopes of moderate aperture two were seen, but in the giant refractor of Mount Hamilton, under the keen vision of Barnard, and in other large telescopes, four of these little attendants were found preceding the parent comet in its sweep through space, as illustrated in Fig. 2. It is on this account sometimes called Brooks' multiple comet.

The mathematicians soon found that the comet was moving in an elliptical orbit, with a period of revolution about the sun of a little over seven years. It is thus a member of our own solar system.

Computing backward, however, they found that it

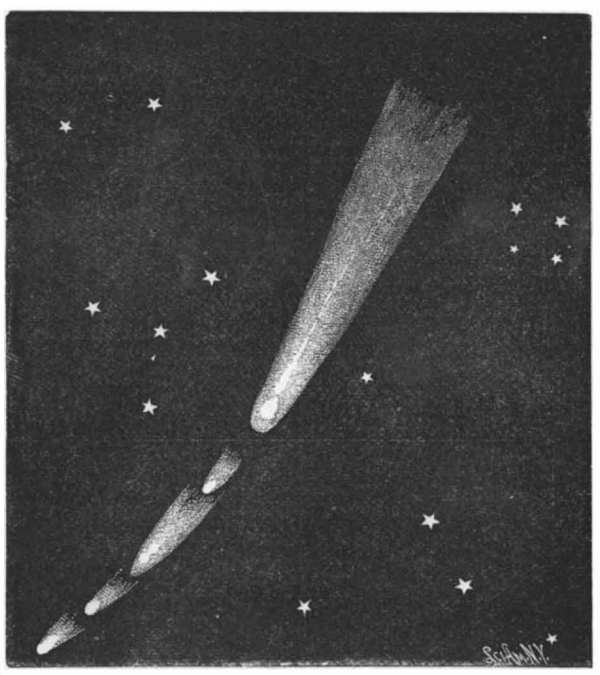


Fig. 2.—BROOKS' PERIODICAL MULTIPLE COMET.†

had not always had this short periodic revolution. It was found by Dr. Chandler that in 1886, or three years previous to the writer's discovery of the comet, it had come into Jupiter's all-powerful attraction, and its orbit and period changed from a previous one of nearly thirty years' duration to its present seven year period.

Nor was this all. It is believed that during this encounter of Jupiter and the comet, the material for the fifth satellite of Jupiter, discovered by Barnard in 1893, was secured—captured from the comet by Jupiter's superior attraction.

* Discovered by Prof. Brooks July 6, 1889.

† Discovered by Wm. R. Brooks July 6, 1896.

I append a short ephemeris of the comet, showing its place in the heavens for the next few weeks.

August.	Right Ascension.	Declination South.
12	22 h. 33 m.	18° 51′
16	22 h. 31 m.	18° 58′
20	22 h. 29 m.	19° 3′
24	22 h. 26 m.	19° 6′
28	22 h. 23 m.	19° 6′
September.		
1	22 h. 20 m.	19° 4′

From these positions the path of the comet may be traced beyond the above dates. The comet is increasing in brightness, reaching perihelion early in November next.

Smith Observatory, Geneva, N. Y., August 7, 1896.

The American Institute Fair.

The American Institute Fair will open at the Madison Square Garden on Monday, September 28, and will close on Thursday, October 29, and during this time there will be shown at the usual popular price of twenty-five cents one of the best exhibitions that the institute has given for a long time. The enterprise of securing the Madison Square Garden has been seconded by the exhibitors, who appreciate that the institute has had no exhibition since 1892. On the main floor, which will be entirely filled by the best class of exhibits, there will be much active machinery, including silk weaving, the making of asbestos cloth, the manufacture of shoes, the making of hand-made paper, an exhibit showing how cigars and cigarettes are made, and motors adapted to boats and other uses, and a horseless carriage as light almost as an ordinary road wagon. There will also be a beautiful display of boats. The bicycle will of course be represented. In the machinery department down stairs there will be ice machines in operation, high-speed and gas engines, printing presses, farming machinery, and novelties always to be seen in the mechanical department. The show of flowers, fruits, and vegetables, beginning October 5 and continuing in the concert hall under the direction of the committee on agriculture, promises to be an especially attractive feature.

The race agent of the American Rules will take charge of the flying of birds from the tower of the garden each day, and will decide upon the awards for number of birds, speed, distance, and will also arrange for the exhibit of homing pigeons during the week ending October 24.

A Machinery Exhibit in China.

The Peking (China) University, an educational institution conducted under the auspices of the American Methodist Episcopal Mission, has recently opened in one of its buildings a museum which it is proposed to devote largely to the exhibition of foreign machinery and mechanical appliances. This museum is visited daily by increasing numbers of people of the better classes, and the authorities would be glad to receive and exhibit working models, photographs, or drawings of machinery and inventions, or specimens thereof, such as plows, ships, firearms, cannon, electric machinery, cars, locomotives, wind mills, looms, printing presses, wagons, engines, etc. Each exhibit which may be presented to them will be marked in Chinese, with the name and address of the maker, together with the description and price, if desired, and a capable translator will explain their use to inquirers.

Correspondence on this subject and articles for exhibition may be sent to the Peking University, Peking, China, or to Mr. Charles H. Taft, treasurer of the Peking University, No. 78 William Street, New York City, and under an arrangement with the I. M. customs will be imported to China free of duty.

Medals or Decorations for Inventors.

An "old SCIENTIFIC AMERICAN reader," writing from Havana, Cuba, suggests that the government, in granting letters patent to an inventor, should at the same time issue to him a distinctive medal, to be worn externally, indicating his membership in the "American Legion of Inventors," who have done so much to promote our wonderful industrial progress. Such a medal, made of silver in the form of a star, to be suspended from a ribbon formed of the national colors, our correspondent suggests, would not only be a highly honorable distinction, but might in many cases be of material benefit to the inventor, acting in a manner as an introduction, and aiding him in efforts to obtain capital to facilitate the introduction of his improvement. Inventors obtaining three or more patents, it is recommended, should have a gold medal; and, for all inventions patented before such a law is passed, it is suggested that the inventors may have the medals issued to them on payment of their cost.

Water Supply for Paris and London.

It is proposed to take 440,000,000 gallons daily to Paris from the lake of Geneva, a distance of about 310 miles. London may have a new supply of fresh water, of equal importance to the Paris supply, from parts of Wales situated at an altitude of 2,790 feet above the sea level, particularly the region from which spring the Towy, Usk, and Wye.

© 1896 SCIENTIFIC AMERICAN, INC.

Forestry as a Science.

Much has been said and written, first and last, about preserving the forests in this country after the methods which have prevailed for half a century and more in Germany and France, and how not only other valuable timber might be saved, but safety from fire and flood should be had.

It is well understood that for these objects all dead wood, whether underbrush or high reaching trees, must be cleared out of the way, and where they leave too wide spaces their places must be filled with other plantations. There is a scientific method and an unscientific way of doing this, and success depends wholly upon which one of these methods is adopted. For such reasons the science and profession of forestry has flourished in other countries than America, having extensive tracts of woodland, for many years, in the same manner that gardening and botany have flourished.

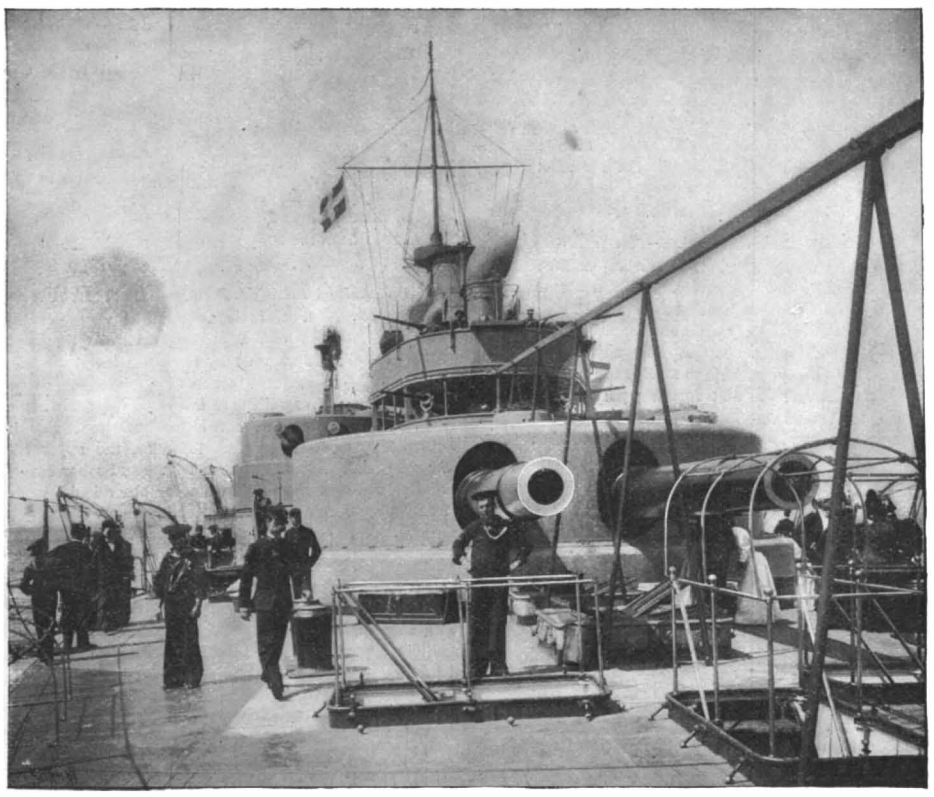
Little or no attention, however, has been paid in America to forestry until recently, says the New York Times, by either private or public persons. The States of New York, Maine, and a few others with extensive forest lands have paid some attention to the subject, but the Federal Government has only just awakened to its importance; and at the last session of Congress a commission of men who have studied the subject was authorized to investigate and report on the condition of the woodlands of the Northwest. The commission, consisting of several professors of arboriculture from the leading universities, like Harvard, Yale, Columbia, and others, with several government officials, is now at its work in Montana. Mr. Vanderbilt was an early exception to the apathy here on the subject of forest preservation, for shortly after the purchase of his estate at Asheville he began to form plans, not only for the preservation of the great domain of woodland which he found in existence, but for the rehabilitation of that portion of it which had been exhausted. The forest was broken and irregular in character, owing to the fact that the land had been divided among many small farmers, who had made frequent clearings, or had robbed the forest of its most vigorous and healthy trees. Scientific measures were required for the work of restoration, and Mr. Vanderbilt resolved to spare neither expense nor care in the scheme. It was a question whether at the end of a term of years he would have a noble forest of park-like character and a certain commercial value, or merely a barren and tangled woodland, gradually going to decay, and liable at any time to destruction by fire. Mr. Vanderbilt accordingly sought for the best talent among those who had made dendrology a study, and was fortunate in obtaining the skillful services of Mr. Gifford Pinchot, a student of forest management in the best schools of Europe, and a man fully alive to the advantages and disadvantages of the different methods in their application in this country. Mr. Pinchot took hold of Biltmore Forest, of about 5,000 acres, which he found was composed mainly of oaks and other deciduous trees, mostly young, with scattered pines, which occasionally covered old and exhausted fields to the exclusion of other species. Nevertheless, there was considerable present and prospective value in the timber and firewood of the forest, and in a report which he made of his findings, a year or so ago, he sketched a scheme in which he proposed three general objects, namely: A profitable production, which will give the forest direct utility; a nearly uniform annual yield, which will give steady employment to a trained force of foresters—woodchoppers and lumbermen; and a gradual improvement in the condition of the forest itself. These objects he proposed to obtain by dividing the estate into the high forest system and the selection system. The rotation—that is, the length of time allowed for a second crop to become ripe on the same ground after the removal of the first crop—has been fixed at 150 years.

In a thoroughly equipped forest, managed under the high forest system, there are as many subdivisions as there are years in the rotation, the trees of each subdivision being of an equal age, and only one year younger than those of the next subdivision. In this way it would be possible to cut every year one one hundred and fiftieth of the whole area, thus securing a uniform annual crop during the whole period. In the selection system forest trees of all ages are mixed together, instead of being separated in groups according to their ages. The annual product is taken from all parts of the forest, the ripe trees being selected for cutting; but such a method necessitates in the case of a large forest area expensive transportation, and to avoid this Mr. Pinchot has adopted what he calls the location selection system, under which the annual yield is taken from a certain part of the forest during several years, then from another part, and so on.

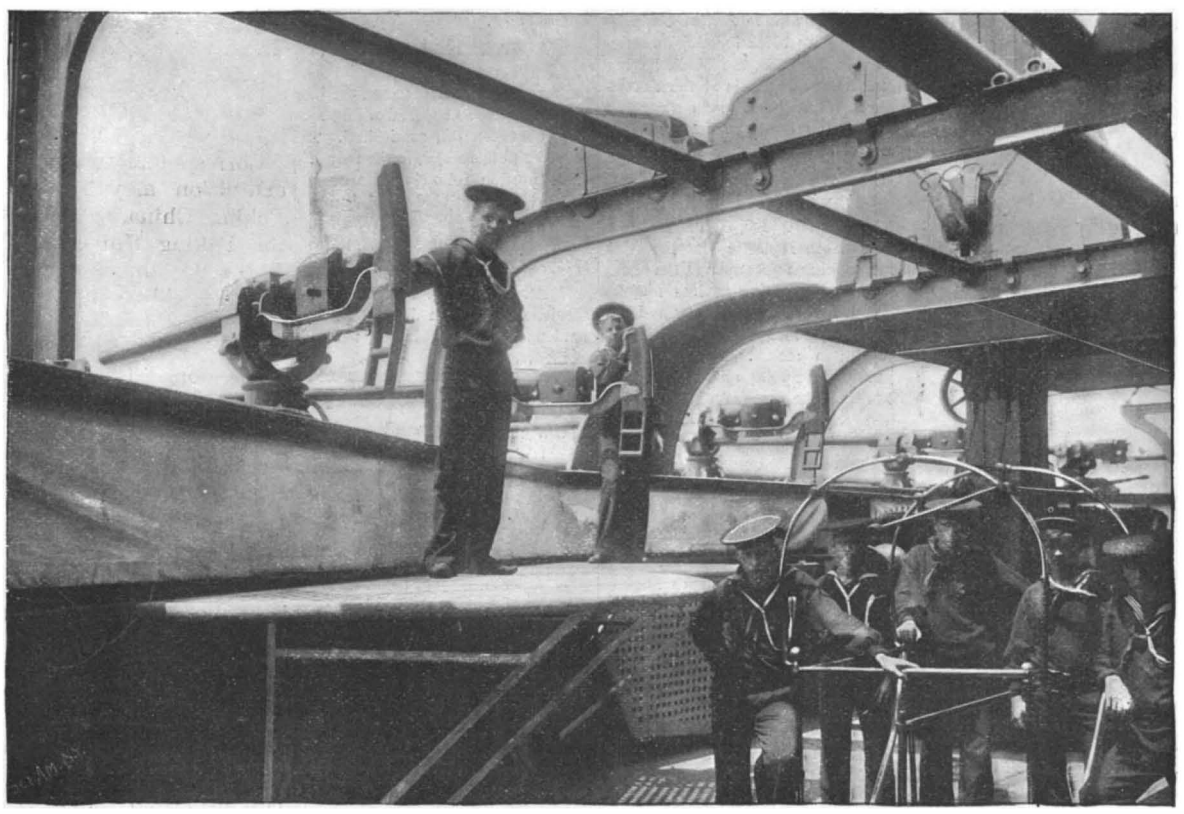
Mr. Pinchot's balance sheet in his report above mentioned, covering the first year's operations of the Biltmore Forest, shows an expenditure of $9,911.76, with receipts amounting to $5,607.11, and material on hand worth at local market prices $3,911.25, or $9,519.36 in all, showing a deficit of only $392.40. In the year 1893 this deficit became a surplus of more than $1,200—a remarkable result, in view of the poverty of the forest he had to operate in and the difficulties which are always attendant upon the establishment of a new industry, especially in one like this, where all his assistants and workmen had to be formed from the very beginning.

But Mr. Vanderbilt has broader and more liberal views in his forest operations than an effort to make his investment pay by improving the property. He intends his forest, for one thing, as an object lesson in forest preservation to the country. Already preparations are on foot for a great arboretum at Biltmore, in which are to be gathered all the trees and shrubs of the temperate regions of the world, which will form a museum of the greatest interest. It will cover some 800 acres of land, distributed along both sides of a road twelve miles in length. Here the nurserymen and foresters of the entire country will be at liberty and have full opportunity to study and gain information as to the character and growth of important forest trees not to be obtained elsewhere.

In connection with this arboretum and the general scheme of forest management at Biltmore, it is said to be Mr. Vanderbilt's intention to establish and equip a school of forestry on or near his estate. Already a number of students are residing near the place, taking practical lessons in the science from Mr. Pinchot and his chief assistants, who are resident foresters. They also have free access to the notable collection of valuable books in the library connected with the arboretum, and which it is also said to be Mr. Vanderbilt's purpose to make a public one.



THE INDIANA—THE AFTER PAIR OF 13 INCH GUNS.



THE BATTLESHIP INDIANA—BROADSIDE 6 POUNDER RAPID FIRE BATTERY.

The Great Krupp Works.

More than 1,250,000 tons of coal are consumed yearly by the famous Krupp Works at Essen, Westphalia, commenced in 1810 by Peter Friedrich Krupp, and now in the possession of Herr Friedrich Krupp, member of the Reichstag. The establishment consists, according to the Eisen Zeitung, of two steel works with fifteen Bessemer converters; four steel works with Siemens Martin open hearth furnaces; iron, steel and brass foundries; puddling, melting, reheating and annealing furnaces; draw benches; a hardening and tempering department; file manufactory; rolling mills for plates, rails and tires; railway spring and wheel manufactory; steam hammers, forges, axle turning shop, boiler shop, engineering and repair shops. Besides the above and many other departments, at Essen, connected with the making of cannons, there are steel works at Annen, in Westphalia, three collieries in Westphalia, besides participation in several others; 547 iron mines in Germany; various iron mines at Bilbao, in Spain; four iron works, including one at Duisburg, one at Engers, one at Neuweid and one at Sahn; various quarries of clay, sandstone, etc.; four steamers, and artillery ground at Meppen, Hanqver.

The property owned extends over 974 hectares; and the number of hands employed in the mines and steel works is 25,301. There are altogether 1,500 furnaces of various kinds, 3,000 engines and machine tools, 22 roll trains, 111 steam hammers, two hydraulic presses, 263 stationary boilers, 421 steam engines, representing together a force of 33,139 horse power, and 430 cranes, including travelers, having a collective lifting power of 4,662 tons.

The total length of the shafting is 8·8 kiloms. (5½ miles), and that of railways, standard and small gage, 85 kiloms. (53 miles), worked by 32 regular trains, with 33 locomotives. The annual consumption of coal amounts to 1,253,161 tons, and that of lighting gas to 12,000,000 cubic meters, while there are 573 arc and 1,804 incandescent electric lamps.

THE Yale lock manufacturers have proved that in a patent lock having six "steps," each capable of being reduced in height twenty times, the number of changes or combinations will be 86,400. Further, that as the drill pin and the pipes of the keys may be made of three different sizes, the total number of changes will be 2,592,600. In keys of the smallest size the total number of changes through which they can be run is 648,000, while in those of large size the number can be increased to not less than 7,776,000 different changes.

© 1896 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Engineering.

CALCINING FURNACE.—Arthur H. Wethey, Butte, Montana. Three patents have been granted this inventor for improvements in furnaces such as illustrated and described in the SCIENTIFIC AMERICAN of May 30, the furnaces being preferably built in pairs, with two furnaces located opposite each other, and each provided with longitudinal hearths or compartments. The furnace is for rapidly and thoroughly desulphurizing ores, in a ground, crushed, or pulverized state. One of the patents is for a traveling shoe to actuate a lever mechanism whereby the end doors are automatically opened to permit rakes or plows to enter or leave the hearth, the doors automatically closing as soon as the rakes or plows have left the door opening. These rakes or plows are for stirring and moving the contents of the furnaces, and another of the patents is for tripping doors to close the slots on the inner sides of the furnace, the doors being self-closing and normally in a closed position, but being opened successively by the passing through of the stirring device. A series of overlapping doors is pivoted at their upper ends and adapted to be engaged edgewise by the axle or other part of the stirring device to cause an upward swinging of the door for the passage of the axle, and one of the patents provides for a carriage mounted to travel and supporting an axle carrying a series of shovels or plows. The carriage is pulled along between the two furnaces, and projecting supports extend into the furnace compartments and with their shovel blades agitate and push forward the material.

Railway Appliances.

CAR FENDER.—William B. Altick, Lancaster, Pa. This fender may be attached either to the front or bottom of a car, to remain there as a fixture, and has two frames, a trip and a bed frame, in connection with a main frame. The two frames are normally lifted from the ground, but the trip frame, when struck by an object in the path of the car, releases the bed frame to lower it and provide a safe receptacle for the object struck, the trip frame also dropping with the bed frame. Any body in the path of a moving car provided with this fender will, it is designed, be caught up without injury and safely retained on a yielding bed until the car is stopped.

FREIGHT CAR DOOR.—Alfred P. Le Gros, Louisville, Ky. Crank arms mounted to swing on the side of the car, according to this invention, carry top and bottom runners on which a door is fitted to slide, and a crank shaft journaled on the car has a hasp forming a handle, the shaft having crank arms engaging bearings on the runners to give them a swinging motion. This door may be conveniently opened and closed, fitting snugly into the door casing, and is especially adapted to facilitate ventilating the car, as the runners may be swung to move the door bodily out of its seat to a position in front of the door opening, with the hasp still locking the door, and preventing the entry of persons without first unlocking the door.

RAILWAY CAR LOAD INDICATOR.—Carl Henrich, Webb City, Mo. This is an improvement in weighing appliances in which an indicating beam is made to move by the movement of the car body under its load, co-operating with a graduated bar by which the amount of the load is determined. The invention provides an improved construction of the fulcrum and pivot of the indicating lever, so that each may be more readily and effectively adjusted, thus making it possible to obtain more accurate results than heretofore practicable.

REFRIGERATOR CAR.—Charles S. Hardy, San Diego, Cal. This is an improvement in cars which have an "ice plug" and other parts co-operating with a lid in closing openings that receive ice in the roof of a car, and provides a plug whose parts are adjustable to permit the conversion of the plug into a ventilator, permitting the same plug to be used in winter, when the cars are employed in the shipment of fruit without ice. The apparatus has a separate outer lid or hatch and an inner ice plug with foldable section, whereby its heart may open up and adapt it to co-operate with the lid or hatch in forming a ventilator and an outer lid or hatch door, avoiding the use of separate structures and insuring the providing of the car with either an ice plug or a ventilator.

Mechanical.

WRENCH.—Thomas Wilson, Dillon, Montana. This tool is especially designed for a nut wrench of quick action and large scope, having a ratchet latch capable of automatically locking and of being readily unlocked by the fingers of the hand grasping the wrench handle. Provision is also made for protecting the ratchet teeth of the locking device from possible injury by contact with objects with which the wrench may be brought in engagement.

MILLING ATTACHMENT FOR LATHES.—Charles C. Keyser, New Decatur, Ala. According to this improvement a frame is adapted to be attached to the lathe in place of the tool post, a live center mounted to be turned in the head stock of the frame, and a dead center adjustably held in the tail stock of the frame. The attachment is of simple and durable construction, quickly attached to the lathe and arranged for producing all kinds of work usually done on high grade milling machines.

CASE REST FOR PRINTERS' CABINETS. William A. Hurrel, Bloomdale, Ohio. To furnish a quick and ready support for any case in a cabinet or rack, allowing the case to be pulled fully out, and thus give access to all the boxes, this inventor provides standards to be attached to the uprights of the cabinet, the standards having channeled sides and offsets and connected arms being adapted to slide upon them, each arm having on its inner face a slideway to receive a case. The rest may be readily adjusted vertically, enabling any case to be brought up or down to a convenient height for setting type from it, and when not needed it may be quickly removed from the rack or cabinet.

HATTERS' SHACKLE.—Frank L. Butterworth, Newark, N. J. This is a tool employed by hatters for curling and ironing the curls of hats, the invention providing a simple and convenient construction adapted to be heated by gas or hydrocarbon vapor, whereby repeated reheating is avoided. A frame carries a handle and a burner, and a removable ironing block is attached to the frame in a position to be heated, the block being readily removable in order that different styles or shapes of brims may be readily ironed by substituting different blocks on the same frame.

FOLDING SHIRT WAISTS.—Joseph Jonasson, New York City. A simple and inexpensive machine is furnished by this inventor by means of which shirt waists and similar articles, after laundering, may be quickly and uniformly folded, the machine being especially adapted to fold ladies' and children's waists that they may be packed and displayed to the best advantage. A forming board is placed on the garment spread out on a slotted table, and pivoted below the table are arms which project through the slots, the arms carrying rollers, which are made to move over the garment, as the folds are made, by the operation of a treadle.

Miscellaneous.

OPTICAL LANTERN.—Charles Goodyear, Jr., New York City. This is a lantern for scientific projection, in which the several attachments are made readily interchangeable, so that the lantern may be used for projections of widely different character without loss of time in making changes and adjustments. The lantern has tubes or sockets to receive the ends of rods or tubes projecting from and forming part of an optical bench, the latter being formed of two rods or tubes with supporting legs, the rods or tubes having extensions to fit the tubes or sockets of the lantern. Adapters are also fitted to the optical bench to hold the shanks of the different attachments, and an auxiliary bench is fitted to the adapters of the main optical bench to receive microscope attachments.

RULER.—Charles F. Windisch, Cincinnati, Ohio. To prevent ink from soiling or blurring the surface being used this inventor provides a ruler formed of separate members of thin material, of metal, wood, celluloid, etc., the members being secured together to leave a narrow free space between them. The upper member is wider and projects at both edges beyond the lower member, so that any ink adhering to the edges will adhere to the upper member only. The edges of the lower member are also coated with paraffin or an equivalent to repel the ink.

MUSIC LEAF TURNER.—John J. Walsh, Yonkers, N. Y. This is a device adapted for attachment to a piano, organ, or music stand, without marring the surfaces to which it is attached, and comprises a casing in which are leaf-turning arms, and devices for attaching leaves of music to the several arms. The invention provides for a quick releasing of the arms, one by one, when a sheet of music is to be turned, and all the music carrying arms may be simultaneously carried over to a position to receive the leaves, and locked in such position.

REFERENCE GUIDE FOR BOOKS.—James H. Hoch, Marion, Kan. For the use of preachers, lawyers, teachers and others, this inventor provides a device to be applied to books to enable the user to readily refer to various texts or solutions. The device consists of an attachment having tablets or markers carried on swinging arms on an articulated frame bar applied to the backs or covers by spring clasps. The articulation of the frame in the middle enables it to open or close and adjust itself automatically to the open or closed condition of the book.

CARRIAGE SHAFT.—Marie F. J. Willemin, Paris, France. This is an unbreakable shaft, having a kind of joint which permits it to fold when the horse falls. The invention provides coupling devices comprising sleeves, bolts, and a coupling block forming an articulated connection between the bolts, the block having lugs projecting between the meeting ends of the sleeves and springs on the bolts. With a shaft made according to this improvement, if the animal falls, no matter in what position he may lie on the shaft, the latter will not be broken.

FENCE POST.—David N. Bay, Dee I. Foreacre, and Ford S. Dye, Cambridge, Ohio. In fence posts made of terra cotta or other plastic material, this invention provides for making a post open at the back, in order that staples and other fastening devices may be readily introduced through the front of the post and secured at the rear for holding fence wires in position. Each post is also made with an anchorage at the base, of a width greater than at any other point, and having such form as is designed to prevent the post from being forced upward by frost in the ground. The material of which the post is made is so utilized that only a minimum quantity is required, and the completed posts may be so packed together as to occupy but small space in transportation.

FLOOR DRAINAGE VALVE.—Oliver Barratt, New York City. This is a valve more especially designed for use in tiled floors of hospitals and other buildings to carry off the floor wash water, insuring a proper closing of the valve after being used by the attendant, to prevent sewer gas from entering the room. The valve has a bowl shaped body in the bottom of which is the valve seat, a yoke carrying a cap extending in the body, while the valve has a flange screwing into the cap to open and close the valve. The cover of the valve is ordinarily flush with the floor, but when opened to let out the wash water, the cover cannot be closed down until the valve is seated to prevent the escape of sewer gas into the room.

RUNNER FOR STOOPS.—Archia L. Ross, New York City. A series of mats, made of rubber or similar material, flexibly connected with each other, and preferably fluted longitudinally, are provided by this inventor as a covering or runner for stoops and sidewalks of private houses, theaters, and other buildings, to prevent slipping and falling in icy weather. Each mat is adapted to hook with its rear end on hooks permanently secured on the steps of the building, and the several mats for the steps are preferably connected by chains, so that when the runner is not in use the several mats may be readily stored away one on top of the other.

WINDOW FASTENER.—Michael F. Robinson, New York City. According to this improvement a gear is mounted to rotate on a supporting plate or casing, a rack meshing with the gear being secured on the window sash, and the casing being provided with square openings in which slides a squared shaft. The shaft carries a stop which is engaged and disengaged from the teeth of the gear when it is moved endwise, and a spring holds the shaft in normal position. When it is desired to raise or lower the window the sliding shaft is moved by a key, when the window may be moved up or down as freely as though a fastener were not applied to it.

STEAM COOKER.—Albert J. Finlay and Charles Wilson, Silverton, Oregon. This is a simple and inexpensive cooker, comprising a body vessel of any desired shape, with a cover, and a tray with legs, adapted to be placed in the vessel. The tray is divided into compartments to contain vegetables, meat, etc., and has fine perforations to permit steam from the water chamber below to pass up into the various compartments, the steam being prevented from escaping into the compartment of the tray until comparatively dry. The tray may be removed from the body receptacle without danger of burning the hands.

PORTABLE ELEVATOR.—John F. Fairman, Axtell, Neb. This is an inclined way elevator having at its upper end a pivoted dump section and jointed trough. A wagon may be hoisted up the elevator to dump its contents in a crib by means of a rope or cable carried over pulleys and then connected with a team. The machine is mounted on wheels to enable it to be readily moved from place to place, the apparatus being especially advantageous as a time and labor saver, avoiding the necessity of shoveling or other hand work in unloading corn and other material from a wagon.

BALING PRESS.—Thomas H. Killingsworth, Waco, Tex. In presses for baling cotton, this invention provides a simple and easily operated device in which the cotton bat is wound into cylindrical form without the use of a metal or similar core. In a frame made in separate sections are mounted rotary drums, there being pressure rollers and tension rollers, each having movable bearings, and endless belts with supporting bands traveling with them. When the compression is accomplished each layer is compressed as it is added, thus adding to the pressure of the interior of the bale.

HOISTING DEVICE.—Alfred Bogardus, Jersey City, N. J. For dumb waiters, etc., this invention provides a device by means of which the dumb waiter may be permitted to descend rapidly or slowly, as desired. Combined with a hoisting shaft on which is a ratchet wheel is a box wheel loosely mounted upon and surrounding the ratchet wheel, there being gravity pawls in the box wheel and a strap brake engaging its periphery. The ratchet wheel turns freely in the box wheel while the load is being lifted, but with the stoppage of pull on the hoisting rope the pawls prevent the descent of the load. By slackening a rope connected with the strap brake, the load is permitted to descend more or less rapidly.

SAFETY ATTACHMENT FOR GAS COCKS.—Charles B. Duffy, New York City. To prevent the accidental opening of a gas cock after the gas has been turned off, this inventor provides a simple attachment whereby the movement of the plug is controlled by a spring-pressed lever operated by a knob or thumb piece adjacent to the finger piece of the cock. Persons not acquainted with the proper manipulation of gas cocks will not be able to light a gas burner having this attachment until its operation is explained to them, and an accidental opening of the cock after it has been closed is rendered impossible.

PARING KNIFE.—John H. Grooters, Boyden, Iowa. This is a knife especially adapted for paring fruit, vegetables, etc., the blade being so located and the device so adjustable that a thin or thick paring may be taken off, as desired. The blade portion is curved and has a slot, in the rear of which, in a countersunk portion following the curvature of the slot, is secured a cutting blade, while in the front wall of the curved slot is secured an adjustable guide plate, by whose movement up or down the thickness of the paring is regulated.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 10 cents each. Please send name of the patentee, title of invention, and date of this paper

NEW BOOKS AND PUBLICATIONS.

HOW TO FEED CHILDREN. A manual for mothers, nurses, and physicians. By Louise Hogan. Philadelphia: J. B. Lippincott Company. 1896. Pp. 236. Price $1.

The fin de siecle child should be a very healthy being, if attention is given to all that is published concerning its welfare. The present book, treating of the advance system of feeding, should be welcomed by those having children in charge; it is a contribution to dietetics, one which will do its part to produce good results upon the coming generations.

THE WISCONSIN ENGINEER. University of Wisconsin Engineering Journal. Quarterly. Madison, Wis. Pp. 160. Price $1.50 a year.

ELECTRICAL ENGINEERING IN MODERN CENTRAL STATIONS. By Louis A. Ferguson, S B Madison, Wis.: Published by the University. 1896. Pp. 259. Price 35 cents.

The last named excellent monograph, by the electrical engineers of the Chicago Edison Company, gives the Edison treatment of the central lighting station, problem, which will be of interest to all electrical engineers. Mr. Ferguson is one of the special lecturers of the University of Wisconsin. We also note the reception of the Wisconsin Engineer, a quarto published by the students of the State University, and containing articles by them, the alumni, and professors, with a valuable index of engineering literature.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

Marine Iron Works. Chicago. Catalogue free.

"C. S." metal polish. Indianapolis. Samples free.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Carpenters.—Make more money. Go into concrete construction, Ransome system. 758 Monadnock Blk., Chi'go.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4, Munn & Co., publishers, 361 Broadway, N. Y.

Concrete.—See Kidder's new book on "Building Construction and Superintendence." Comstock, 23 Warren Street, N. Y.

Stay with your job, and with your wages pay installments for a profitable olive orchard. Booklet free. Whiting's Olive Colony, Byrne Building, Los Angeles, Cal.

☞Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6931) J. B. O. says: Can you give me directions for preparing russet leather shoe polish?

A. 1. Soft soap..... 2 parts.
Linseed oil..... 3 "
Annatto solution (in oil) ..... 8 "
Beeswax..... 3 "
Turpentine..... 8 "
Water..... 8 "

Dissolve the soap in the water and add the annatto; melt the wax in the oil and turpentine, and gradually stir in the soap solution, stirring until cold.

2. Palm oil.....16 parts.
Common soap.....48 "
Oleic acid. .....32 "
Glycerin..... 10 "
Tannic acid. ..... 1 "

Melt the soap and palm oil together at a gentle heat, and add the oleic acid; dissolve the tannic acid in the glycerin, add to the hot soap and oil mixture, and stir until cold.

3. Oil turpentine.....20 parts.
Yellow wax..... 9 "
Common soap ..... 1 "
Boiling water.....20 "

Dissolve the wax in the oil with the aid of the water bath, and the soap in the water; mix the two solutions in a hot mortar, and stir until cold.—American Druggist.

(6932) W. S. writes: I have twenty-five 16 candle power lamps, 50 volts, drawing their supply from a 50 ampere transformer. I want to know how to make a dimmer. A. For a dimmer use insulated copper wire of the same size as that of your present lead. Wind it in a coil one foot long and two inches internal diameter. Mount a bundle of iron wires as near 2 inches in diameter as possible, to slide in and out of the aperture. With a current of sufficiently high frequency of alternation this will be a large enough dimmer. By sliding the core in, the lamps are dimmed.

(6933) E. F. G. writes: I desire to make an alum cell for microscopic projection, to restrain the heat from the microscopic object. How thick should the alum cell be? What proportion of alum should be used in the solution? A. Curve a ½ inch square strip of rubber, so as to form the bottom and ends of the cell. On opposite sides of this strip clamp pieces of plate glass. The glass should be at least ⅛ inch thick. The space between the glasses should be ½ inch at least. A strong, but not quite saturated, solution of alum should be used. Water alone answers a very good purpose. To avoid the formation of air bubbles, the alum solution, as well as the water, should be boiled and put in bottles to cool, the bottles being corked as soon as filled. If air bubbles should form in the cell, they may be dislodged by means of a feather or a wire. A piece of heavy rubber tube may be used instead of the rubber strip.

(6934) H. C. S. writes: Please give me the directions and what material to use in making a dry battery. A. Ammonium chloride, 1 part by weight; plaster of Paris, 3 parts; water, 2 parts. Some makers use in addition to this a small proportion of zinc oxide, also of zinc chloride.

(6935) W. W. C. asks: 1. How long should a spark be to take radiographs? A. Two inches. 2. What is the length of spark given by induction coil in SUPPLEMENT, No. 160? A. One to one and a half inches. We have not the other records asked for. 3. In

© 1896 SCIENTIFIC AMERICAN, INC.

SUPPLEMENT, No. 160, do you think by insulating coils better that spark can be increased in length, if I used 2 pounds of double covered silk instead of bare wire in No. 160, would it pay to do that way? A. Silk covered wire is no better than bare wire, provided the latter does not short circuit. A very slight increase in size of coil No. 160 would enable it to give a two inch spark. 4. Can better effects be obtained from a Tesla coil for less cost than ordinary coil? A. The Tesla coil gives very fine results, but introduces more expense. 5. You say that the length of spark depends on the amount of wire in primary coil. Does not length of spark depend on voltage and the voltage on the ratio between the number of convolutions on primary and secondary coil. If too much wire is put on primary, will not the ratio of the two be too uniform thus shortening the spark? A. You misapprehend the case. The extra current in the primary makes its turns efficient in increasing the voltage in the secondary. This voltage depends on the lines of force of the primary, and these vary directly with the number of turns in it. 6. I have the use of a lathe, but it has no device to wind wire, as in SUPPLEMENT, No. 160. Do you not think it would pay to use at least single covered wire? A. It might as a matter of security.

(6936) F. E B. writes: My ice house is filled with choke damp or fixed air, which renders it dangerous and almost impossible for any one to go down into it and remain a sufficient length of time to get a supply of ice. Can you tell me how to get rid of it? A. There is one efficacious cure—ventilation. If this is objectionable or impossible, place a large shallow box containing freshly slaked and thoroughly wet lime upon the surface of the ice or packing. One or two bushels of lime should effect the cure.

(6937) R. A. says: I would be pleased to know of a good formula for making a quick drying retouching preparation for photograph negatives, and how to apply it? A. This powder is prepared by mixing together—

Dextrine..... 2 parts.
Resin (very finely powdered)..... 1 part.

It may be employed both for application to negatives and to albumenized prints. A leather stump is the best means of application.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 4, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Agricultural machine draught attachment, A. N. Cross..... 565,135
Alarm. See Fire alarm.
Amalgamator, T. G. Barlow-Massicks..... 565,152
Articulator and flask and dental process, combined, K. R. Bragg..... 565,326
Asphaltum and making same, artificial, R. Dean.. 564,975
Autographic register, Whitlock & White..... 565,195
Awning center support, W. Wetteroth..... 565,247
Awning for windows, shade, C. J. Waterhouse..... 565,192
Baby chair, swing and crib, combined, P. P. Tardis..... 565,047
Baling press, T. H. Killingsworth..... 565,081
Ball scoring device, base, S. D. McElroy..... 565,141
Basin plug, H. C. Freshour..... 565,409
Basket, A. Kuhn..... 565,006
Bath and shower apparatus, combined, J. F. Foley..... 565,408
Bath apparatus, Lyons & Beemer..... 565,010
Bed bottom, A. McKnight..... 565,018
Beehive attachment, J. Hill..... 565,353
Bell ringing mechanism, J. H. Strain..... 565,306
Bicycle lock, M. N. Frederick..... 565,161
Bicycle rack, H. Westphal..... 565,057
Bicycle rack or stand, H. Westphal..... 565,058
Bicycle, two side seated, A. S. Weaver (reissue).. 11,561
Bicycle wheel runner, C. D. Chatterton..... 565,067
Blowers, impeller for rotary, T. W. Green..... 565,347
Boiler. See Flame tube boiler. Steam boiler. Water tube boiler.
Boiler cleaner, J. McFarlane..... 565,387
Boiler flue attachment, H. H. Sperry..... 565,370
Boiler safety device, steam, C. Ward..... 565,149
Bookcase, revolving, W. S. Lynne..... 565,083
Book holder, J. A. Blackmer..... 564,964
Book reference guide, J. H. Hock..... 565,354
Book, specification, F. H. Paradice..... 565,120
Book stack, C. W. Trowbridge..... 565,189
Books, binding reversible forms of writing, H. W. Ellsworth..... 565,381
Bottle, B. H. Thornton..... 565,187
Bottle and case, combined, W. S. Thomson..... 565,373
Bottle, non-refillable, G. W. Steffens..... 565,242
Bottle stopper, E. L. Lloyd..... 565,362
Bottle stopper, A. J. Robinson..... 565,333
Bottle stopper, J. P. White..... 565,194
Bottle stopper attachment, Robinson & Doran.... 565,392
Bottle top, J. A. Moller, Jr..... 565,012
Box. See Cigar box. Musical box.
Bracket. See Scaffold bracket.
Brake. See Car brake. Fluid pressure brake. Wagon brake.
Brake beam, H. C. Williamson..... 565,060
Brake shoe connection, J. J. Kinzer, Jr..... 565,004
Brake staff, A. M. Ammons..... 564,960
Brick machine, C. S. Meyers..... 565 291
Brick machine cut off, P. H. Kells..... 565 210
Brick machine, hydraulic, W. N. Graves..565,111 to 565,113
Bridge, J. I. Newburg..... 565,020
Broiler, meat, C. Devoy..... 565,107
Broom, L. T. M. Slocum..... 565,042
Brush, fountain tooth, F. C. Howe..... 565,273
Brush, rotating, G. H. Rendel..... 565,218
Buckle, G. F. Stansbury..... 565,396
Buggy boot fastener, D. W. Knesily..... 565,005
Buggy curtain support, S. E. Basden..... 565,321
Buggy jack, B. Porter..... 565028
Burial casket face plate, N. Kolle..... 565,282
Burner. See Fuel burner. Gas burner.
Button, E. Kempshall..... 565,276
Button with shifting links, link, A. Bippart..... 564,963
Buttons, etc. fastening for, F. S. McKenney..... 565,388
Cable grip, J. Pohlig..... 565,027
Cake beater, W. Lawton..... 565,007
Camera, photographic, E. Gleason..... 565,204
Can. See Key opening can.
Can cleaner, J. C. Rust..... 565,234
Can opener, A. C. Scarr..... 565,094
Can opener, Smalstig & Mayer..... 565,367
Car awning ventilator, C. A. Bennett..... 565,401
Car bolster, W. Case..... 565,404, 565 405
Car brake, automatic, A. E. Wildman..... 565, 248
Car coupling, N. A. Cooper..... 564,973
Car coupling, J. H. Estes..... 565,110
Car coupling, R. G. Hardesty et al..... 565,114
Car coupling, B. Owen..... 565,025
Car door fastening, mine, A. Maxwell..... 565,289
Car door, freight, A. F. Le Gros..... 565,286
Car, elevated railway, W. T. Shaffer..... 565,124
Car fender, W. B. Altick..... 565,055
Car fender, safety, W. A. & H. W. Blakeney..... 565,256
Car seat, F. A. Baier..... 565,375, 565,376
Cars, load indicator for railway, C. Henrich..... 565,271
Carriage seat fastener, C. Goings..... 565,345
Case. See Bookcase. Egg case.
Casting apparatus, ingot, J. A. Potter..... 565,296
Catapult, E. L. Chesebro..... 565,259
Centrifugal machine, P. L. Kimball..... 565,278
Centrifugal machine, N. G. Williams..... 565,196
Centrifugal separator, P. L. Kimball..... 565,281
Centrifugal separator, N. G. Williams..... 565,197
Chain link, lubricating, A. J. B. Berger..... 565,199
Chair. See Baby chair.
Chair seat, F. Ring..... 565,231
Channeling machine, bar, Halsey & Doney..... 564,993
Checkrein hook, J. R. Gump..... 565,268
Churn, P. Catinna..... 565,330
Churn and butter worker, combined, L. A. Disbrow..... 564,978
Churn and butter worker, combined, R. B. Disbrow..... 564,977
Churn dasher, C. Berst..... 565,130
Cigar box and cabinet, S. M. Friede..... 565,265
Circuit breaker, Tobey & Smith..... 565,244
Cleaner. See Boiler cleaner. Can cleaner. Dish cleaner. Stovepipe cleaner.
Clevis, plow, J. S. Hogan..... 565,079
Clip. See Conductor's hand clip.
Cloth pressing machine, D. Gessner..... 565,071, 565,072
Cloth roll stands, adjustable guide for, J. Wilkinson..... 565,315
Cloth spreading apparatus, J. Goldenberg..... 564,989
Clothes line fastener, A. & G. A. Kurtis..... 565,212
Clothes line reel, Wright & Kelsey..... 565,064
Clutch, A. B. Ireland..... 565,002
Clutch, combined frictional and positive, B. C. Waite..... 565,190
Clutch, friction, C. S. Mott..... 565,016
Clutch, safety driving, D. E. Barnard..... 565,415
Cock safety attachment, gas, C. B. Duffy..... 564,980
Coffin handle, S. B. Campbell..... 564,403
Comb, W. H. Noyes..... 565,389
Combination lock, H. E. Mooman..... 565,363
Compass box reflector, A. Mitchell..... 565,011
Compound engine, H. D. Dunbar..... 565,335
Conductor's hand clip and check case, L. R. Thomas..... 565,051
Conveyer, J. M. Dodge..... 565,334
Conveyer and distributer, J. F. Dornfeld..... 565,068
Cooker, steam, Finlay & Wilson..... 565,340
Cork cutting and grinding machine, H. S. Larsen. 565,285
Corn holder, E. D. Son..... 565,369
Cotton press, H. G. Ellis..... 565,069
Couch, invalid's, W. L. Logsdon..... 565,287
Counter, moving, F. Rucquoy..... 565,180
Coupling. See Car coupling. Shaft coupling. Thill coupling.
Crank and pitman connection, Curran & Whalley. 565,261
Cuff holder, Haven & Smith..... 565,078
Curry comb, W. L. Frisble..... 564,987
Curtain rod support, W. S. Grant..... 565,075
Cut off and pointing machine, H. H. Rockwell et al..... 565,090
Cutter. See Pipe cutter.
Cyclometer, A. F. Rockwell..... 565,034
Dam, revetment, and jetty and apparatus for building same, J. I. Newburg..... 565,019
Decorticating ramie, etc., machinery for, P. P. Faure..... 564,982
Digestive compound, J. Carnrick..... 565,329
Digger. See Potato digger.
Dilator, Rectal irrigating, P. C. Meengs..... 565,386
Dish cleaner, S. E. Williams..... 565,317
Door check, F. Wankel..... 565,100
Door check and closer, C. E. Brunthaver..... 565,377
Door guard, O. H. Hicks..... 565,206
Drier. See Grain drier.
Dumping apparatus, J. R. Wilson..... 565,399
Dust pan attachment, S. F. Williams..... 565,059
Eccentric, C. Linstrom..... 565,169
Egg case fastener, W. D. Mayfield..... 565,115
Egg whipper, G. T. Cook..... 565,260
Electric arc light globe, S. Heimann..... 565,269
Electric conductors, connecting device for, H. Gilmore..... 565,344
Electric motor, J. Conner et al..... 565,155
Electrical conductors, subway for, W. H. Hart.... 564,994
Electrode, secondary battery, G. Hubner..... 565,140
Electrolier, N. L. Root et al..... 565,092
Electrolysis, H. Blumenberg, Jr..... 565,324
Electrotherapeutic apparatus, H. E. Waite..... 565,056
Elevator. See Grain elevator. Portable elevator.
Engine. See Compound engine. Gas or oil engine. Rotary engine. Steam engine. Wind engine.
Excavator for hydraulic dredgers, A. B. Bowers.. 565,132
Exhibition apparatus, W. M. Cline..... 564,971
Eyelet, J. C. Rhodes..... 565,091
Fastenings into leather, machine for inserting metallic, L. Goddu..... 565,073
Feed distributer, J. Lucas..... 565,008
Feed mechanism, boiler, F. W. Ofeldt..... 565,119
Fence post, D. N. Bay et al..... 565,322
Fencing, machine for making wire, W. Edenborn. 565, 380
Fender. See Car fender.
Filter, J. F. Ziegler..... 565,250
Filter, water, C. C. Moore..... 565,416
Fire alarm, automatic electric, C. D. Tisdale..... 565,188
Fire alarm signal box, G. F. Milliken..... 565,086
Fire alarm system, electrical, J. D. Gould..... 565,410
Fire alarm system, electrical, C. D. Tisdale..... 565,053
Fire alarm systems, electric cable for, H. A. Reed..... 565,178
Fire alarms, cable for electric, H. A. Reed..... 565,217
Fire extinguisher, portable, C. N. Perkins..... 565,215
Fishing or other lines, sinker for, A. B. Quinan... 565,030
Fishpole support, S. D. Horton..... 565,001
Flame tube boiler, W. Schmidt..... 565,041
Floor drainage valve, O. Barratt..... 565,320
Fluid pressure brake, D. Dunn..... 564,981
Folding table, J. W. Ernest..... 565,339
Fruit gatherer, Banzet & Berger..... 565, 101
Fuel burner, fluid, Stapp & Hamilton..... 565,128
Furnace. See Smoke consuming furnace.
Furnace, W. Oehlstrom..... 565.214
Furnace doors, device for automatically opening or closing, A. H. Wethey..... 565,311
Furnaces, shaking grate for domestic hot air, J. T. Austin..... 565,400
Furnaces, stirring device for calcining, A. H. Wethey..... 565,313
Furnaces, tripping door for calcining, A. H. Wethey..... 565,312
Fuse, double acting mechanical, F. Maubeuge.... 565,172
Game apparatus, J. B. Sargent..... 565,235
Garment, bicycle, M. Beck..... 565,066
Garment holder, W. Nolan..... 565,023
Garment supporter, C. E. Henderson..... 565,270
Gas burner and grate bar, combined, L. C. Thiele. 565,050
Gas mixer, E. N. Dickerson..... 565,157
Gas or oil engine, J. Robison..... 565,033
Gas producer, W. J. Taylor..... 565,048
Gas vending apparatus, automatic, J. Fox..... 565,383
Gases, apparatus for separating, V. Drewsen..... 565,263
Gate. See Railway gate.
Gate, C. E. Holmes..... 564,999
Generator. See Polyphase generator. Steam generator.
Governor, electrical, M. A. Replogle..... 565,032
Grain drier, J. E. Turney..... 565,055
Grain elevator and conveyor, combined, J. R. Harrison..... 565,076
Grater, nutmeg, A. A. Freeman..... 565.070
Gravel, etc., washer for auriferous, T. G. Barlow-Massicks..... 565,151
Grooving machine, H. W. Morgan..... 565,213
Hair pin, H. A. Belden..... 565,255
Hair pin, L. F. Hock..... 565,207
Hammer, steam, T. R. Morgan, Sr..... 564,015
Handle. See Coffin handle.
Harvester, corn, W. M. Platt..... 565,026
Harvester reel, B. F. Stewart..... 565,184
Harvesting apparatus, cotton, W. K. Dana..... 564,974
Hat curling machine, Comes & Newman..... 565,154
Hat or felt pouncing machine, R. Eickemeyer.... 565,158
Hatter's shackle, F. L. Butterworth..... 565,104
Heater. See Water heater.
Hoe, mortar, W. H. Dickson..... 565,379
Hoisting device, A. Bogardus..... 565,402
Hook. See Checkrein book. Lacing hook.
Horse releasing device, S. L. Wilson..... 565.062
Hose nozzles, outlet closing device for, J. H. Melavin..... 565,290
Hose support, D. H. Warner..... 565,127
Hose supporter, L. G. Abbott..... 565,251
Hydrants, antifreezing cover for, J. W. Moodie... 565,013
Hydraulic machine transformer, T. R. Morgan, Sr..... 565,014
Hydraulic motor, J. I. Newburg..... 565,022
Ice palace, C. F. McGlashan..... 565,175
Ink, pen and penholder carrier, combined, M. Scougale..... 565,095
Insects or microbes on plants, means for destroying, J. Fuchs..... 565,384
Insulating handle connection, J. Rogers..... 565,393
Iron. See Sad iron. Soldering iron.
Jack. See Buggy jack.
Jar or bottle, C. H. Stadelman..... 565,371
Key opening can, W. H. Gilbert..... 565,162
Knife. See Paring knife.
Knitting machine stop motion, Cobb & Rickmeyer..... 565,134
Knob attachment, C. F. Doebler..... 565,108, 565,109
Lace bearing for shoes, W. P. Bliss..... 565,131
Lacing hook, shoe, C. E. Van Norman..... 565,099
Lamp, bicycle, H. S. Hirsh..... 565 ,272
Lamp burner, J. Gregory..... 564,991, 564 ,992
Lamp, street, J. Stewart..... 565,044
Lantern, D. W. Corbet..... 565,156
Lantern carrying device, Y. Thompson..... 565,052
Lathe milling attachment, C. C. Keyser..... 565,277
Level, J. A. Traut..... 565,097, 565,098
Levels, apparatus for adjusting spirit, J. A. Traut..... 565,096
Linotype bars, letter for, A. B. Adair..... 565.252
Liquid separator, P. L. Kimball..... 565.279, 565.280
Lock. See Bicycle lock. Rim lock. Wagon seat lock.
Locomotive, electric, R. Eickemeyer..... 565,407
Lubricator, F. Caum..... 564,970
Match lighting attachment for lanterns, etc., F. Hill..... 564,997
Mechanical motor, F. P. Bishop..... 565,200
Medical compound, W. W. Spaulding..... 565,125
Metal founding, T. Doherty..... 565,262
Metallic article, compound, W. J. Taylor..... 565,243
Meter. See Target meter.
Meter, C. F. Holdship..... 565,208, 565,209
Mill. See Pulverizing mill.
Mining gold, etc., H. Frasch..... 565,342
Motor. See Electric motor. Hydraulic motor. Mechanical motor.
Mucilage, J. A. Link..... 565.361
Mucilage holder, A. Buhler..... 565,328
Music leaf turner, J. Reigart..... 565,031
Music leaf turner, J. J. Walsh..... 565,306
Musical box, F. H. Sander..... 565,093
Nailing machine, L. Goddu..... 565,074
Necktie G. Kraus..... 565,283
Necktie fastener, C. Mole..... 565,087
Net making machine, S. H. Roberts..... 565,232
Nozzle, self closing, A. J. Knight..... 565,211
Nut lock, W. Harrison..... 565,077
Nut lock, J. S. Oakley..... 565,142
Oil distributing apparatus, F. Caum..... 564,969
Oils, refining hydrocarbon, G. M. Saybolt..... 565,039
Oiler or can, locomotive valve, F. Young..... 565 129
Optical lantern, C. Goodyear, Jr..... 565,046
Ordnance breech mechanism, M. Gledhill..565,163, 565,164
Pail handle bearing, E. Mohr..... 565,292
Paint, lustrous, J. B. O. Suidter..... 565,147
Paper box machines, cutting and scoring roll for, E. H. Taylor..... 565,186
Paper, machine for manufacturing roofing, M. Ebret..... 565,336
Paper making machine attachment, E. Riley..... 565,121
Paper rolling machine, wall, J. W. Meyer..... 565,116
Paring knife, J. H. Grooters..... 565,348
Petroleum distillates, refining, G. M. Saybolt.... 565,040
Photographic apparatus, coin controlled, J. Powers..... 565,297
Photographic roll holder, Blair & Kelley..... 565,323
Pipe. See Tobacco pipe.
Pipe cutter, J. J. Griffin..... 565,267
Pipe sections, apparatus for forming couplings for, H. E. Boyd..... 565,257
Pipe thimble, D. A. Brislin..... 564,967
Pipe union, L. P. King..... 565,411
Plow, subsoil, E. M. Hickman..... 565,352
Pneumatic dispatch tube receiving box, L. G. Bostedo..... 564,965
Pole tip, T. N. Martin..... 565,412
Polyphase generator, compound wound, B. G. Lamme..... 565,284
Portable elevator, J. F. Fairman..... 565,382
Post. See Fence post.
Potato digger and separator, T. E. Sadler..... 565,181
Power, art of and apparatus for measuring, C. Sellers..... 565,303
Power, distribution and regulation of, H. B. Gale 565,138
Power, method of and means for electric regulation of, H. B. Gale..... 565,139
Press. See Baling press. Cotton press.
Printers' cabinets, adjustable case rest for, W. A. Hurrel..... 565,274
Printing and adding machine, automatic, J. H. Eickershoff..... 565,337
Printing implement for obtaining correct register in color, C. H. Cohen..... 565 153
Propeller, ship, J. D. Mark..... 565,170
Propeller vessel, J. I. Newburg..... 565.021
Propulsion, mechanism for and mode of marine, S. Lawrence..... 565,359
Pulley, automatic clutch, J. N. Starr..... 565,241
Pulverizing mill, T. McGlew..... 565,176
Pump, steam, J. B. Rhodes..... 565,391
Pumps, auxiliary exhaust apparatus for oscillating wing, G. Ailweiler..... 564,959
Punch, ticket, A. P. Odell..... 565,364
Rail bond, F. E. Buxton..... 564,968
Rail, extension guard, J. W. Ernest..... 565,338
Railway, H. L. Stillman..... 565,045
Railway conduit electric, C. D. Mattison..... 565,085
Railway, electric, H. Brandenburg..... 565,102, 565,103
Railway gate, Fennell & Woodward..... 564,983
Railway head, A. W. Mathewson..... 565,084
Railway tie and means for securing rails thereto, metallic, J. M. Hoon..... 565,000
Recorder. See Time recorder.
Reel. See Clothes line reel.
Reel carrier, B. F. Trembly..... 565,054
Refrigerator car, C. S. Hardy..... 565,351
Register See Autographic register.
Revolver, J. H. Wesson..... 565,246
Revolver, D. B. & J. H. Wesson..... 565,245
Rim lock, W. H. Taylor..... 565,372
Rivets, studs, etc., making, C. E. Test..... 565,049
Rotary engine, G. J. Scott..... 565,123
Ruler, C. F. Windisch..... 565,319
Sad iron, electric, F. H. Date et al..... 565,136
Sad iron holding and storing device, J. S. Hall.... 565,350
Saddletree, harness, A. S. Dersch..... 564,976
Sales recording apparatus, F. N. Brewer..... 565,133
Sash fastener, F. E. Jarvis..... 565,168
Saw, C. Prouty..... 565,298, 565,390
Saw tooth, J. R. Luce..... 565 ,288
Scaffold bracket, C. Morgan..... 565, 293
Scale, platform, H. Schuster..... 565,122
Screen. See Window screen.
Separator. See Centrifugal separator. Liquid separator.
Sewing machine Fowler & Warren..... 564,985
Sewing machine, carpet, H. Eschweiler..... 565 264
Sewing machine, shoe, Fowler & Warren..... 564,986
Shade, adjustable, A. F. Espersen..... 565,203
Shaft, carriage, M. F. J. Willemin..... 565,316
Shaft coupling, W. H. Nicholson..... 565,068
Shafting, universal joint coupling for, W. Esty... 565,159
Shears, D. C. Wheeler..... 565,193
Sheet metal drawing machine, R. J. Good..... 564,990
Sheet metal vessel, E. F. O'Toole..... 565,024
Shirt waist folding machine, J. Jonasson..... 565,275
Shoe stretcher, D. Fletcher..... 565,341
Siding spacing gage, J. A. Ratcliff..... 565,299
Signature gatherer, D. M. Smith..... 565,145, 565,146
Sled, A. Peterson..... 565,143
Sleigh, J. Jensen..... 565,003
Slicer, vegetable, C. H. Anspach..... 564,962
Smoke bleaching cap for chimneys, J. T. Sands... 565,036
Smoke consuming furnace, J. M. Thomas..... 565,307
Snow plow, street railway, M. Hoffman..... 564,998
Soldering iron, electric, F. H. Date et al..... 565,137
Spool moulding machine, Wilson & Clementson.. 565,061
Spring. See Vehicle spring.
Stamp, printing, T. S. Buck..... 565,327
Stamp protector, W. H. Northall..... 565,295
Steam boiler, F. W. Dean..... 565,106
Steam engine, compound, Wolf & Pond..... 565,063
Steam generator, N. W. Pratt..... 565,029
Steam trap, Dixon & Allbee..... 564,979
Stencil sheet compound, T. H. Stackhouse..... 565, 043
Stoker, mechanical, Ayres & Ranger..... 565,253
Stone working machinery, W. R. Young..... 565,249
Stoop runner, A. L. Ross..... 565,301
Stopper. See Bottle stopper.
Stove, B. Hellmann et al..... 564,996
Stovepipe cleaner, W. L. Gerard..... 564,988
Strainer, puree, J. Prince..... 565,089
Swaging or welding machine, S. P. Cooke..... 564,972
Swing, W. J. Hall..... 565,165
Table. See Folding table.
Tack or nail, W. O. Taylor..... 565,397
Target meter, R. F. Lauger..... 565,358
Telephone and district alarm system, combined, F. Drake..... 565,202
Telephone substation apparatus, A. de Khotinsky..... 565,080
Telephone switchboard, Stromberg & Carlson..... 565,046
Telephoning from cars, M. Garl..... 565 385
Thill coupling, F. Clyde..... 565,331
Ticket holder, L. W. Davis..... 565,333
Ticket issuing device, C. O. Tangeman..... 565,185
Tie. See Railway tie.
Tile, roofing, P. F. Jones..... 565,356
Time recorder, watchman's, C. E. Sanford..... 565,037
Tire, adjustable wheel, J. B. Watt..... 565 398
Tire, pneumatic, Brown & Brosnan..... 565,258
Tire tightener, W. G. Simpson..... 565,366
Tires, implement for repairing pneumatic, C. L. Pepper..... 565,313
Tobacco packing machine, C. W. Guerrant..... 565,349
Tobacco pipe, F. W. Schroeder..... 565,183
Tobacco pipe attachment, H. Seidler..... 565,302
Toes of footwear, device for stiffening, W. D. Brewer..... 564,966
Tool handle, P. H. Lettre..... 565,360
Toy, J. Baer..... 565,254
Toy, J. W. Weaver..... 565,309
Toy for making soap bubbles, J. C. Daugherty... 565,332
Toy, mechanical, B. W. Annin..... 564,961
Track brush holder, W. E. Shepard..... 565,144
Train dispatcher's chart board, J. T. Williams.... 565,150
Trap. See Steam trap.
Tripods, adjustable leg for, T. H. B. Pierce..... 565,216
Trolley system, underground, Sherman & Kenyon..... 565,240
Trolley wire support, L. McCarthy..... 565,174
Trolley wire suspending and supporting device, C. H. Fisk..... 564,984
Truck, W. Case..... 565,406
Twine holder for binding corn, grain, etc., W. Z. Harmon..... 565,167
Typewriter and telegraphic transmitter, combined, C. E. Yetman..... 565,128
Typewriter practice keyboard, J. S. Rhodes..... 565,179
Typewriting machine, Marshman & Burridge..... 565 171
Typewriting machine, E. Terry..... 565,148
Typewriting machine inking mechanism, V. F. Lake..... 565,357
Typewriting machines, mechanical movement for, J. B. Lyford..... 565,009
Undergarment, J. C. Sanford..... 565,182
Valve for water tanks, siphon, M. H. Wilcox..... 565,314
Valve, gate, W. H. H. Sheets..... 565,239
Valve siphon bottle, F. E. Morrill..... 565,173
Valve, stop and waste, W. B. Guimarin..... 565,205
Vanning machine and concentrator, W. H. Hooper..... 565,355
Vehicle, foot propelled, G. G. J. Millar..... 565,117
Vehicle spring, M. L. Senderling..... 565,238
Vehicle, two wheeled, J. C. F. Dick..... 565,201
Vehicle wheel, F. J. Woods..... 565,198
Ventilator. See Car awning ventilator.
Violin bow, E. O. Spitzner..... 565,395
Wagon body, J. Muir..... 565,294
Wagon body brace, H. W. Pogue..... 565,177
Wagon brake, J. A. Pryor..... 565,365
Wagon, dumping, W. Haywood..... 564,995
Wagon dumping, M. L. Senderling..... 565,236
Wagon seat lock, J. G. Romenesko..... 565,035
Wagon, sleigh or cabinet, convertible, J. G. Weber..... 565,310
Wagon, sliding body dump, M. L. Senderling..... 565,237
Wardrobe, traveling, P. A. Shanklin..... 565,305
Water heater, multitubular, W. R. Roney..... 565,394
Water tube boiler, sectional, R. & R. Munroe, Jr. 565,017
Weather strip, C. Saville..... 565,038
Weighing and packing machine, F. H. Richards.. 565,228
Weighing machine, F. H. Richards. 565,219 to 565,226, 565,229
Weighing machine housing, F. H. Richards..... 565,227
Well boring machine, J. M. Geisinger..... 565,343
Wheel. See Vehicle wheel. Wind wheel.
Wheel, E. S. Cobb..... 565,378
Wheel rims, gluing press for wooden, O. A. Hanford..... 565,166
Wind engine, D. C. Walling..... 565,191
Wind wheel, D. E. Barnard..... 565,414
Windmill gearing, J. G. Carnahan..... 565,105
Windmill, R. J. Mitchell..... 565,118
Window bead fastener, Smalstig & Mayer..... 565,368
Window fastener, M. F. Robinson..... 565,300
Window screen, adjustable, W. J. Greenman..... 565,266
Window screen, sliding, J. Shankey..... 565,304
Wire stretcher, M. Ewart..... 565,160
Wrapping soap, etc., machine for, M. Kirshner... 565,082
Wrench, T. Wilson..... 565,318
Writer's hand support, W. L. Yarbrough..... 565,374

DESIGNS.

Bath tub, C. F. Arrott..... 25,896
Bicycle alarm, P. E. Matthes..... 25,880
Bicycle cover, G. E. Constantin..... 25,879
Bicycle saddle, A. D. Carre..... 25,877
Bicycle stand, J. Nesbitt..... 25,878
Box lid, P. O. Dickinson..... 25,893
Bracket, J. G. Noyes..... 25,868
Brush, J. K. Robinson..... 25,894
Brush, M. Young..... 25,895
Buckle, C. F. Reynolds..... 25,860
Buckle, cotton tie, H. F. Mueller..... 25,861
Can, syrup, W. Helmer..... 25,856
Cane head or handle, F. S. Evans..... 25,851
Car seat panels, rib for, J. A. Brill..... 25,897
Carpet, R. F. Doherty..... 25,906
Carpet, F. M. Parker..... 25,907
Carpet, H. W. Parton..... 25,904, 25,905
Chair, school, G. A. Bobrick..... 25,897
Eyelet, E. Kempshall..... 25,862
Fence stey, wire, Q. I. Simpson..... 25,885
Fire pot lining, A. B. Clunes..... 25,888 to 25,890
Game board, W. H. Redheffer, Jr..... 25,900
Gong striker cap, J. Mundell..... 25,881
Guy slip, H. B. Thompson..... 25,867
Helmet, campaign, M. T. Smith..... 25,850
Hoof hook, J. Pinkerman..... 25,866
Hook, display, McDonald & Bachrach..... 25,865
Hook, lacing, E. Kempshall..... 25,863, 25,864
Inhaler, C. W. McKee..... 25,858
Lamp base, A. Patitz..... 25,871 to 25,874
Lamp, bicycle, M. F. Carey et al..... 25,876
Lamp chimney, A. J. Alcock..... 25,870
Lamp fount holder, A. Patitz..... 25,875
Last, T. J. Solon..... 25,892
Panel for ceilings, W. R. Kinnear..... 25,886
Piano case, P. M. Zeidler..... 25,898
Plush or pile fabrics, pattern for, C. M. Aikman... 25,901
Press frame, J. K. Krieg..... 25,884
Presser bar, S. M. Jacoby..... 25,882
Raisin seeder frame, A. C. Williams..... 25,869
Rug, E. H. Bennett..... 25,903
Rug, A. Petzold..... 25,905
Sealer's tool, car, W. F. Fallon..... 25,883
Spool holder, R. Fraser..... 25,891
Spoon, A. F. Shriver..... 25,859
Spoons, etc., handle for, L. R. Horton..... 25,853
Spoons, etc., handle for, H. L. Wallace..... 25,854, 25,855
Type, font of, C. Schraubstadter, Jr..... 25,899
Vessel, handled, T. B. Brown..... 25,857
Water front, A. B. Clunies..... 25,891

TRADE MARKS.

Bicycles, Bettys & Mabbett Company..... 28,725
Bitters, stomach, L. E. Jung & Company..... 28,712
Blacking, boot or shoe, Pike Manufacturing Company..... 28,720
Borax and its compounds, soap and powders and lotions for cleansing and toilet purposes, Pacific Coast Borax Company..... 28,719
Candy attached to the ends of sticks, round or oblong pieces of, J. F. Birkmeyer & Sons..... 28,717
Canned salmon, J. M. Chapman..... 28,718
Cement, imported, C. Zunz..... 28,723
Cigarettes, F. Lopez..... 28,706
Coffee made of grain, substitutes for, O. F. Woodward..... 28,714
Coffee substitute, Potter & Wrightington..... 28,713
Cotton drillings, Lawrence Manufacturing Company..... 28,700
Cotton sheetings and cotton shirtings, Lawrence Manufacturing Company..... 28,701
Cotton sheetings and shirtings, Monohansett Manufacturing Company..... 28,702
Cultivators, harrows, shovels, spades, hatchets, hammers, twist drills, wrenches and kindred articles, Whitman & Barnes Manufacturing Company..... 28,728
Cultivators, shovels, thrasher teeth, mower knives and sections, axes, hatchets, hammers, twist drills, wrenches and kindred articles, Whitman & Barnes Manufacturing Company.. 28,729
Fabrics, yarns, underwear and knit goods, including hosiery, Commonwealth Cotton Manufacturing Company..... 28,703, 28,704
Grapevines, fresh, canned and preserved grapes and wine, J. R. Johnson..... 28,708
Harrows, disk, Moline Plow Company..... 28,727
Harvesters, mowers and separate parts thereof, self binding, Milwaukee Harvester Company.. 28,726
Honey, strained, Deming & Gould Company..... 28,716
Malt extracts, English Diastasic Malt Extract Company..... 28,711
Medical purposes, effervescent salt for Schenck & Stiebeling..... 28,707
Paper, carbon, A. P. Little..... 28,698
Roofing felt and building paper, New York Coal Tar Chemical Company..... 28,699
Rubber goods, especially bicycle tires, cementing and healing compound for, K. Linn..... 28,722
Syrups and extracts for beverages, fruit, D. S. McDonald Company..... 28,715
Tonic malt liquor, C. A. Lammers Bottling Company..... 28,710
Underwaists for women and children, T. B. Fitzpatrick..... 28,705
Varnishes, firm of C. W. Schmidt..... 28,724
Wax, inks, stains, furniture polish and tailors' crayons, shoemakers', Levy & Company..... 28,721
Whisky, Mackie & Company, distillers..... 28,709

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

© 1896 SCIENTIFIC AMERICAN, INC.

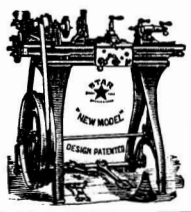
Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.



Star Lathes ★ Foot power Screw... ...cutting Automatic Cross feed
9 and 11-inch Swing.
New and Original Features
Send for Catalogue B.
Seneca Falls Mfg. Company,
695 Water St., Seneca Falls, N.Y.

AMERICAN PATENTS.—AN INTEResting and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002**. Price 10 cents. To be had at this office and from all newsdealers

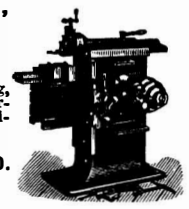
POWER & FOOT LATHES. SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

STEEL CASTINGS From 1 to 40,000 Pounds Weight of Open Hearth, Chester or Bessemer Steel,
True to Pattern. Sound. Solid.
GEARING OF ALL KINDS, CRANK SHAFTS, KNUCKLES FOR CAR COUPLERS,
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives. *Steel Castings of every description.*
CHESTER STEEL CASTINGS CO.
Works, Chester, Pa. Office, 409 Library St., Phila., Pa.

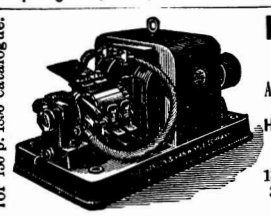
GATES ROCK AND ORE BREAKERS LEAD ALL OTHERS IN • ECONOMY • DURABILITY • CAPACITY •
ESTIMATES furnished for COMPLETE CRUSHING PLANTS
We manufacture **MINING MACHINERY** of every description.
Gates Iron Works, Dept. C. 650 Elston Av. Chicago, Ill

Wet Tool Grinder
It runs an Emery or Corundum Wheel 14 inches in diameter and 2 inches thick. Has no pumps to get out of order. Does its work perfectly. Is easily cleaned. Will grind four times as fast as a grindstone.
C. N. CADY,
W. Center Street, Canastota, N. Y.

THE "SPRINGFIELD"
15 and 20 inch
CRANK SHAPERS.
Most Convenient, Simple, Strong, and Durable Shapers in the market. Has many points of superiority over others.
Send for Circular C S. Address
SPRINGFIELD MACH. TOOL CO.
Southern Avenue,
Springfield, Ohio, U. S. A.



Send your business card for 150 p. 1896 catalogue.



NICKEL AND **Electro-Plating** Apparatus and Material.
THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
35 & 37 S. Canal St., Chicago.

The Curtis Balanced Steam Trap
Combines more Superior Features than any other Trap in the market.
☞ *Send for circular S. C. giving particulars.*
D'ESTE & SEELEY CO.
29-33 Haverhill St.,
BOSTON.

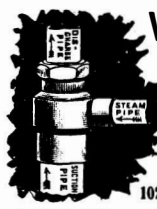
THE COBURN PATENT TROLLEY TRACK

Barn Door Hangers
Impossible for door to jump the track.
Very simple and cheap to apply.
☞ *Send for Book.*
THE COBURN TROLLEY TRACK MFG. CO.,
HOLYOKE, MASS.

BARNES' UPRIGHT DRILLS
Complete line, ranging from Light Friction Disk Drill to 42" Back Geared Self-Feed. ☞ *Send for New Catalogue.*
W. F. & JOHN BARNES CO.
1999 Ruby Street, ROCKFORD, ILL.

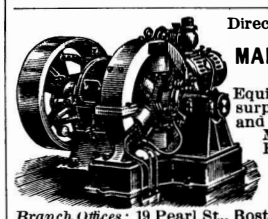
DO YOUR OWN PRINTING $5. PRESS for cards, circulars, &c Press for printing a small paper, $40.
Save money! Make money printing for others! Type-setting easy. Printed rules Write for catalogue, presses type, cards, etc., to factory.
KELSEY & Co.
Meriden, Conn

PERFORATED METAL
OF EVERY DESCRIPTION
AND FOR ALL USES
THE HARRINGTON & KING PERFORATING CO.
225 NORTH UNION STR CHICAGO ILL. U.S.A.
AND 284 PEARL ST NEW YORK



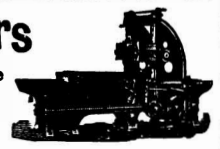
VANDUZEN STEAM JET PUMP
THE BEST IN THE WORLD.
Pumps Any Kind of Liquid.
Always in Order, never Clogs nor freezes. Every Pump Guaranteed.
10 SIZES.
200 to 12000 Gallons per Hour.
Cost $7 to $75 each. Address
THE E. W. VANDUZEN CO.,
102 to 108 E. Second St., Cincinnati, O.

PORTABLE SINGLE RAIL SURFACE Railway.—Details of construction and description of rolling stock of a new system of portable railway which may be laid upon ground that has received no special preparation for its reception. With 19 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1014**. Price 10 cents. To be had at this office and from all newsdealers.



Direct Coupled Engines and Dynamos for
MARINE and LOCAL LIGHT PLANTS
Equipment complete and unsurpassed. Electric Motors and Dynamos, Bipolar and Multipolar. ⅛ to 150 h. p. For particulars, address
BELKNAP MOTOR CO.
HOME OFFICE,
Portland, Me., U. S. A.
Branch Offices: 19 Pearl St., Boston. Thames Bldg., N.Y.

Metal Planers
and General Line of Machine Shop Tools.



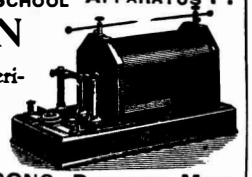
Hill, Clarke & Co.
160 Oliver Street, BOSTON.
16 So. Canal Street, - - - Chicago.

FOR BICYCLE MANUFACTURERS
QUINT'S TURRET DRILLS
Arranged for Tapping with from two to twelve spindles.
A. D. QUINT,
4 Clinton St., Hartford, Conn., U. S. A.

Stark No. 4 Bench Lathe

with Milling Attachment
JOHN STARK
WALTHAM, MASS.
☞ *Send for catalog B.L.*
Tuerk Bros., 35-45 West Randolph Street, Chicago, Ill. Chas. Churchill & Co. Ltd., 21 Cross Street, Finsbury, London, E. C., England.

. . PHYSICAL AND SCHOOL APPARATUS . .
INDUCTION COILS for experiments in X rays and other electrical work.
☞ *Catalogue Free.*



E. S. RITCHIE & SONS, BROOKLINE, MASS

SMALL MOTORS for All Purposes.

The best manufactured. Specially adapted fo all kinds of light work, sewing machine outfits toys, dental drills, jewelers' lathes, models, etc. Send for Catalogue. **The LEAVITT MOTOR CO.,** Manufacturers of Electric Motors and Electrical Specialties, 122 Mitchell St., PROVIDENCE, R. I.

ELECTRO-CHEMISTRY, RECENT ADvances in.—By J. W. Richards, A.C., Ph.D. A very exhaustive and interesting paper on the progress that has recently been made in the apparatus for and methods of prosecuting work in the domain of electro-chemistry. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **1014** and **1015**. Price 10 cents each. To be had at this office and from all newsdealers.

DROP FORGINGS
WYMAN & GORDON
WORCESTER, MASS.
28 BRADLEY STREET.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for inventors.

In this line of business they have had *nearly Fifty years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing Patents in all the principal countries of the world.

MUNN & CO., SOLICITORS OF PATENTS,
361 BROADWAY, NEW YORK.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street. WASHINGTON, D. C.

If you want the best CHUCKS, buy Westcott's

Little Giant Double Grip Drill Chucks, Little Giant Drill Chucks Improved, Oneida Drill Chucks, Cutting-off Chucks, Scroll Combination Lathe Chucks, Geared Combination Lathe Chucks, Plain Universal Lathe Chucks, Independent Lathe Chucks. Made by Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

A Boiler Feeder For High Pressures
WORKS AT 150 TO 250 LBS. STEAM as easily as OUR STOCK INJECTOR AT 25 TO 150 LBS.
May we tell you about it?
PENBERTHY INJECTOR CO.,
116 Seventh Street, DETROIT, MICH.

WIRE Machinery for making any articles from **WIRE**
Automatic wire forming machine department is in charge of R. C. Manville.
Machinery for making sheet metal goods.
THE WATERBURY MACHINE CO.,
P. O. Box 1025,
WATERBURY, CONN., U. S. A.

IDEAS DEVELOPED. Absolute secrecy. Send for particulars. Advice and suggestions free. Correspondence and sample orders solicited. Models, Patterns, Castings, etc. Gardam & Son, 96 John St., N. Y.

SYCAMORE CASE of 1, 2, 3, 4, 6, 9, 12 Inch Tempered Rules

Also 4 inch Narrow and Center Gage. P. P. until Sept. 1st for $4.00. Sawyer Tool Co., Athol, Mass.

MODELS & GEARS EXPERIMENTAL WORK CATALOGUES FREE
UNION MODEL WORKS CHICAGO

Light and fine machinery to order; models and electrical work specialty. E. O. CHASE, NEWARK, N. J.

EDGE TOOLS

are often nearly ruined by using a grindstone not adapted to the work. Our quarries produce a large variety of grits suitable for grinding any tool.
☞ *May we send you our Catalogue, which will give you some information?*
GRAFTON STONE COMPANY,
No. 80 River Street, GRAFTON, OHIO.

Elbridge Electrical Mfg. Co.

Our 8 Light Dynamo.

ELBRIDGE, N. Y.
MANUFACTURERS OF
. . . High Grade Dynamos and Motors for Light and Power.

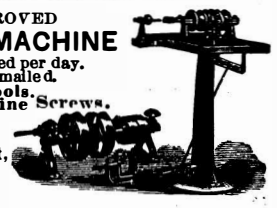
BUY TELEPHONES
That Are Good--Not Cheap Things
The Richmond, Ky., Telephone Co. tried other apparatus, which failed to operate satisfactorily and speak highly for the "Western" put in place of it.
Hundreds of similar cases may be cited affecting the apparatus of nearly all so-called competitors.
WESTERN TELEPHONE CONSTRUCTION CO.
250 South Clinton Street, Chicago
The Largest Manufacturers of Telephones in the U. S.

ESTABLISHED 1850.
THE DEFIANCE MACHINE WORKS
No. 401 PERRY ST. DEFIANCE, OHIO, U.S.A.
MANUFACTURERS OF SPECIAL WOOD WORKING MACHINERY FOR HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE, SHAFT, POLE, NECK-YOKE, SINGLETREE, HANDLE & BARREL-HOOP FACTORIES.
LARGEST LINE IN THE WORLD
SATISFACTION GUARANTEED.

Sand Belt Machine

FREE SAMPLE COPY OF HOME STUDY.
...An Elementary Journal for Students of Mechanics, Electricity, Architecture, Mining, Plumbing, Heating and Ventilation, Steam Engineering, Civil Engineering, and Mechanical and Architectural Drawing.
HOME STUDY, Box 942, Scranton, Pa.

NEW IMPROVED
TAPPING MACHINE
25,000 holes tapped per day.
Description mailed.
Machinery and Tools.
Brass Machine Screws.
HARVEY HUBBELL,
875 State Street,
Bridgeport,
Conn.



DO YOU USE GRINDSTONES?
If so, we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue.*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

-- THE --
SCIENTIFIC AMERICAN

☞ **ESTABLISHED 1845.**
The Most Popular Scientific Paper in the World
Only $3.00 a Year, Including Postage.
Weekly--52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year* - 52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **Three Dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Postmasters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology. Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography. Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT, for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York.

Building Edition.

THE SCIENTIFIC AMERICAN BUILDING EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates* and other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Floor Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to
MUNN & CO., 361 Broadway, New York.

Export Edition

of the SCIENTIFIC AMERICAN, with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN is published monthly, and is uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places *throughout the world*. $3.00 a year, postpaid, to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost. Rates upon application.
MUNN & CO., Publishers.
361 Broadway, New York.

© 1896 SCIENTIFIC AMERICAN, INC.

THE BLISS School of Electricity

Bliss Building, WASHINGTON, D. C.

The only Institution teaching practical Electrical Engineering exclusively. Laboratory equipment excellent. Instruction the best. Catalog on application.

Durable—Easily Applied.

This roofing is manufactured from natural Trinidad asphalt materials, and will not dry up and become brittle under exposure to the weather as coal-tar roofings do. ☞ *Send for free sample of roof 12 years old, with circular and price list to*

WARREN CHEMICAL & MFG. CO.,
85 Fulton Street, New York, U. S. A.

X RAY CAMERA

Roentgen and Edison out-done. The great up to date Sensation! Penetrates any object inserted between its lenses, no matter how thick or dense. You can see through a solid piece of iron or a part of your body, as through a crystal; of all optical marvels ever discovered this is the most wonderful. Two sets of compound lenses in handsome telescope case 3 1-2 in. long. Sells for 25c. Sample complete and mailed post-paid with catalogue of 1000 Bargains for 15c, 2 for 25c, $1.25 Doz. AGENTS WANTED.

E. H. Ingersoll & Bro., Dept. No. 14 65 Cortlandt St., New York.

CROOKES TUBES AND ROENTGEN'S Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **181, 189, 238, 243, 244, 792, 795, 905, 980, 1050, 1054, 1055, 1056, 1057,** also SCIENTIFIC AMERICAN, Nos. **7, 8, 10** and **14,** vol. 74. These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each To be had at this office and from all newsdealers.

"SURE STEP"
Rubber Cushion Tread Horse Shoe.

Positively prevents slipping, stumbling, jar, concussion, calking, or interfering. Adopted and in use by leading Fire Departments, Livery and Private Stables. Consists of steel skeleton shoe, perfect in shape, size, weight, and durability; provided with Rubber Cushion Tread adapted to take a firm hold upon the ground. Price per set, complete, $2.00. *Illus. circulars sent free. Agents Wanted*

F. W. HAHN, Mfr., 358 Grand St., N.Y.

Patent Improved Self-Lubricating Fifth Wheel

FOR ALL VEHICLES.

Used and indorsed by leading carriage builders. Lower half is composed of wrought iron. Upper half of fine bronze, in which a series of pockets are set, filled with a compound of graphite under high pressure. Absolutely self-lubricating.

Manufacturers of Graphite Bushings, Bearings, and Washers. *Illustrated circulars sent free.* **GRAPHITE LUBRICATING CO., Box 8, Bound Brook, N.J.**

See Illus. Article Sci. Am. June 23, 1894.

The Berkefeld House Filter

The only Filter Removing Typhoid and Cholera Bacilli. Tested and indorsed by many leading authorities in Europe and America. It gives a continuous flow of filtered water, absolutely free from germs. It is easily cleaned, as all impurities remain on the surface of the filtering cylinder. Cylinders can be sterilized by boiling in water for one hour. Send for circulars and prices to the

BERKEFELD FILTER CO., 4 Cedar Street, New York.

WOODEN TANKS.

For Railroads, Mills and Manufactories. Builders of Steel Towers and Tanks. La. Red Cypress Wood Tanks a specialty.

W. E. CALDWELL CO., 217 E. Main Street, Louisville, Ky.

AUTOMOBILE CARRIAGES: THE Paris-Bordeaux-Paris Race of.—Brief account of the performance of the vehicles that obtained the prizes in the competition instituted by the Petit Journal. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1023.** Price 10 cents. To be had at this office and from all newsdealers.

RHOADS LEATHER BELT PRESERVER

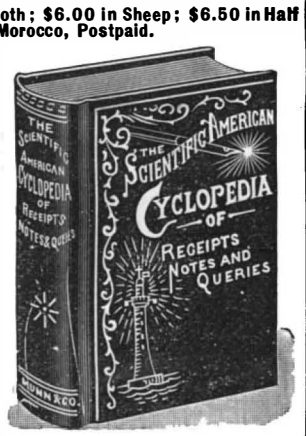
GIVES LIFE, FLEXIBILITY, AND ADHESIVENESS. AN UNGUENT WITHOUT ROSIN OR CHEMICALS. 10 LB. CAN, REGULAR PRICE $2.00, AND A DOES BELT PUNCH. PRICE 50 CENTS. SENT FOR $2.00 IF YOU MENTION SCIENTIFIC AMERICAN. J. E. RHOADS & SONS, MAKERS OF THE RHOADS BELT. FACTORY WILMINGTON, DEL. 239 MARKET ST. PHILA. PA.

Twelfth Edition Now Ready.

THE SCIENTIFIC AMERICAN CYCLOPEDIA OF Receipts, Notes and Queries

12,500 RECEIPTS. 708 PAGES.

Price, $5.00 in Cloth; $6.00 in Sheep; $6.50 in Half Morocco, Postpaid.



THIS great work has now been on the market for nearly six years, and the demand for it has been so great that twelve editions have been called for.

It is entirely distinct from the ordinary receipt book in being thoroughly up to date.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use. Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.

Those who are engaged in almost any branch of industry will find in this book much that is of practical value in their respective callings. Those who are in search of independent business or employment, relating to the home manufacture of salable articles, will find in it hundreds of most excellent suggestions.

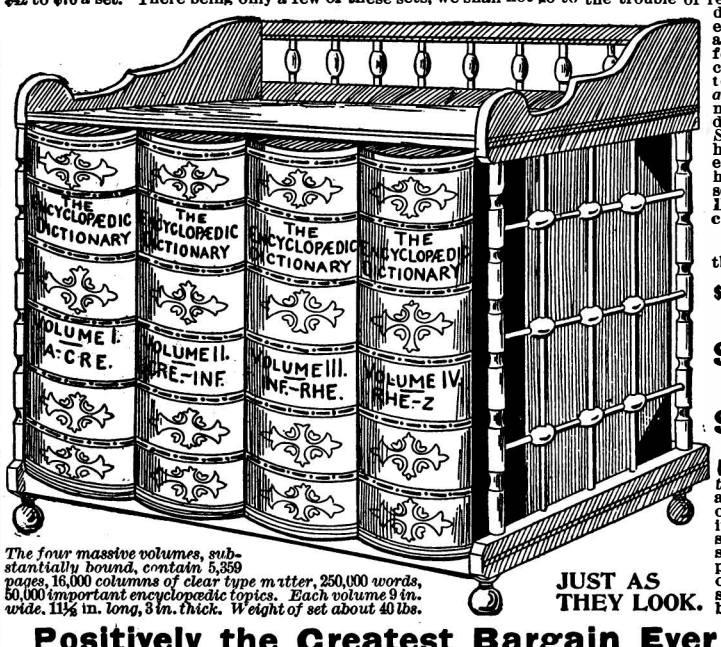
☞ *Send for descriptive circular.*

MUNN & CO., Publishers, 361 Broadway, New York.

GREAT SPECIAL OFFER!

POSITIVELY WILL NEVER AGAIN BE PRESENTED.

In making an inventory at the close of our recent Introductory Distribution, we find in stock a few sets of **The Encyclopædic Dictionary** (in cloth and half-Russia bindings only) that are **slightly damaged**—not enough to impair their real value, but sufficient to prevent their shipment as perfect stock at our regular prices of $42 to $70 a set. There being only a few of these sets, we shall not go to the trouble of rebinding them, but have decided to let them go on easy payments of $1 down and $2 a month until paid for at about half our recent very low introductory prices. By *prompt action now*, therefore, a number of ambitious and deserving readers of *The Scientific American*, who have felt unable to pay even the small prices heretofore charged, may secure these **Slightly Damaged Sets at half cost of making.**



The four massive volumes, substantially bound, contain 5,359 pages, 16,000 columns of clear type matter, 250,000 words, 50,000 important encyclopædic topics. Each volume 9 in. wide, 11½ in. long, 3 in. thick. Weight of set about 40 lbs.

JUST AS THEY LOOK.

While They Last

they are yours for a lifetime this easy way:

$1 down and $2 a month until paid.

Cloth Style,

$9.00 A SET

Regular Price, $42.00.

Half-Russia Style,

$11.00 A SET

Regular Price, $52.50.

WE GUARANTEE that these books are damaged only by slight rubs or abrasions on the binding. In every other respect they are exactly the same as those sold at full prices. Yet we cannot offer them as perfect stock, and our loss shall be your gain. This is

Positively the Greatest Bargain Ever Offered!

For those persons of limited means who are trying to "get along" with older and inferior reference works, but who really desire to possess one of the latest and greatest of all home libraries, this is a really wonderful opportunity.

WHAT THE ENCYCLOPÆDIC DICTIONARY IS.

It contains over **250,000 defined words**—nearly twice as many as the largest "unabridged"—giving the history, derivation, spelling, pronunciation, and varied meanings of each legitimate English word. It is now accepted as *an unquestioned authority* wherever the English language is spoken.

It is one of the best of all Encyclopædias, because *practically useful* as well as the latest and most scholarly. 50,000 encyclopædic subjects, the Britannica has about 27,000. *Just think of it!* The whole range of human knowledge condensed for your *instant use* by such world famous scientists as Huxley, Proctor, and a hundred other educators of hardly less renown! It is a *time saver* for busy men; a *college education* for plodding students; a *brain developer* for ambitious mechanics; an inexhaustible treasure house of information for each member of every family. It easily takes the place of any half dozen other reference books that could be named. It is truly a *family necessity.*

It is an ornament to any library; beautifully printed and substantially bound; four great volumes, profusely illustrated, *costing more than $750,000 to produce,* and never before offered (except during our recent introductory sale) for less than $42.00 to $70.00 a set.

WHAT THE ABLEST CRITICS SAY.

"The Encyclopædic Dictionary is a library condensed into four volumes; a ton of diffusiveness reduced to forty pounds of quintessence."—Rev. Dr. CHAS. H. PARKHURST, March 9, 1896.

"It forms in itself a library for the busy man of affairs, the mechanic ambitious to advance himself in his line or the student or apprentice just making a beginning."—*Scientific American,* August 8, 1895.

"Has no superior in any of the qualities that go to make up a good dictionary. I give the work my hearty commendation."—Ex-Judge NOAH DAVIS, March 12, 1896.

"The work is undoubtedly an exceedingly useful and trustworthy one."—*Sunday School Times,* May 11, 1895.

"It has all the utility of a superior unabridged dictionary, and all the practical usefulness of a 25 volume encyclopædia without its diffuseness."—*Ram's Horn,* November 16, 1895.

"The skill and judgment with which the dictionary and encyclopædia have been blended can be appreciated only by comparing The Encyclopædic with other dictionaries."—*Public Opinion,* September 19 1895.

HOW TO SECURE THIS GREAT BARGAIN. Bring or send $1 to the New York Newspaper Syndicate, 91 and 93 Fifth Ave., New York, and the entire set of four superb volumes, bound in cloth, will be forwarded. The balance is to be paid at the rate of $2 monthly for 4 months. The first payment for either binding is only $1. In sending your first payment please designate the style of binding you desire, and indicate how you wish the volumes sent, as the charges for delivery must be paid by purchaser. Remittances received after this special lot is exhausted will be immediately returned. The limited stock at our disposal cannot last long. To protect ourselves against bookdealers, etc., we must decline to send more than 2 sets to any one party, and in every case we must require the full name and address of each person receiving a set. We have only two styles of binding in this lot—cloth and half-Russia—about an equal quantity of each. Order at once to make sure. The absolute confidence of the syndicate that the work will be thoroughly appreciated, highly valued and cheerfully paid for is clearly shown by sending such a valuable set of books, the subscription price of which is from $42 to $70 on an advance payment of only $1. We refer to any newspaper in New York. **The Half-Russia Binding will be supplied for $1 down and one extra monthly payment.**

REMEMBER

These sets are as good, for all practical purposes, as those for which we are getting regular prices. We guarantee that the interiors are not injured, and the bindings of our standard grade. The most serious damage to any set is no greater than might occur in a few days' use.

This is actually the chance of a lifetime.

NEW YORK NEWSPAPER SYNDICATE, 91 and 93 Fifth Ave., New York

MONITOR MARINE GAS ENGINES AND LAUNCHES

NO BOILER, RETORT OR FIRE. NO HEAT, SMOKE OR ODOR.

MONITOR VAPOR ENGINE & POWER COMPANY
GRAND RAPIDS, MICHIGAN.
EASTERN OFFICES, LUDLOW STATION, YONKERS, N.Y. CATALOGUE FREE.

High-Grade Row Boats

14 feet long, 40 inches wide, Square stern. Cedar planked, Oak trimmed, and Copper fastened . . **$35**

Ribs, seats, transom, gunwales, and top streaks finished in natural wood. **Second Grade Boats $30.**

All boats hand-made, after Peterson model. Warranted. **Steam, Sail, Vapor** and **Gasoline Launches made to order.** Specifications furnished.

One-half with order, balance C. O. D.

THE ST. JOE RIVER BOAT WORKS, Box 485, St. Joe, Michigan.

C. F. SPLITDORF, MANUFACTURING ELECTRICIAN.

Induction Coils, Magnets, Special Wire Winding, etc.

17-27 Vandewater St., New York.

KLINE'S PATENT IMPROVED

Boss Jar Holder and Top Wrench

Entirely new—Fits any jar.

No more burned hands in canning fruit—No more broken jars while filling—No trouble to carry hot jars—No more bad temper trying to open jars—No more trouble to close them—Made of best steel wire and rubber—Will last a lifetime. Price 50c. per set

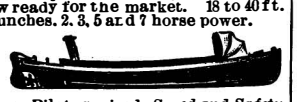
Agents Wanted. **KLINE & CO., Mfrs., 4 River Street, Florin, Pa.**

THE SUBMERGED PIPE LINE ACROSS the Willamette River at Portland, Oregon.—By F. and A. S. Riffle. Description of a line of 28-inch cast iron submerged pipes forming portion of the main line constructed during 1893 and 1894, to supply the city of Portland with pure water from Bull Run, a mountain stream thirty miles distant. With 18 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **1019** and **1020.** Price 10 cents each. To be had at this office and from all newsdealers.

ALCO VAPOR LAUNCH

Engine and Helm Controlled from Bow

Latest improved and only 12 to 1 Motor now ready for the market. 18 to 40 ft. Launches. 2, 3, 5 and 7 horse power.



No licensed Engineer or Pilot required. *Speed and Safety guaranteed. No Dangerous Naphtha or Gasoline used.*

Marine Vapor Engine Co., Jersey City, N. J.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

They have a tone that's all their own . . . . .

THE NEW DEPARTURE BELLS are the standard of excellence the world over. Made in 16 different styles and prices. Send postal for booklet to **THE NEW DEPARTURE BELL CO., 210 North Main Street, Bristol, Conn., U. S. A.**

NEW LONDON — WORCESTER, BOSTON, VIA NORWICH LINE 5.30 P.M. FROM **PIER 40, N.R.,** EXCEPT SUNDAYS.

THE DIRECT ROUTE FOR WATCH HILL AND BLOCK ISLAND.

DEAFNESS

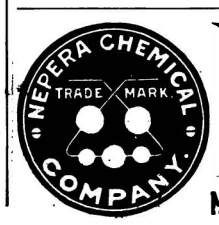
and HEAD NOISES relieved by using

Wilson's Common Sense Ear Drums.

New scientific invention, entirely different in construction from all other devices. Assist the deaf when all other devices fail, and where medical skill has given no relief. Safe, comfortable, and invisible; no wire or string attachment. Write for pamphlet.

WILSON EAR DRUM MANUFG. CO., Louisville Trust Co. Building, Louisville, Ky.

☞ *Mention this paper.* and 1122 Broadway, New York



VELOX PAPER

A Revolution in Photographic Printing.

When exposed to the same light, prints **500 times quicker than albumen. . .**

GLOSSY or MATT. No dull or rainy weather to interfere with your work. No dark rooms nor complicated manipulation.

Developed and toned *as fast as the printing frames can be filled. A choice of tones more beautiful than can be produced on any other paper.* Permanent prints. The greatest paper for hot or damp climates. 50 cents in stamps brings two sample dozen cab's, developer and three sample prints. Nepera Platinoid, Enameled and Rough *Bromide Papers* are the best and most uniform in the market. Nepera P O P, an *insoluble* gelatine paper. Rembrandt, a Matt Printing-out Paper.

Nepera Chemical Co., Sole Manufacturers, NEPERA PARK, N. Y.

PAINT A HOUSE

inside with Patton's Paint, and you will be delighted with its beauty. Paint it outside with Patton's Paint, and you will marvel at the many years it will last.

PATTON'S PURE LIQUID PAINT is the best and cheapest paint made.

$1.50 per gallon. Freight paid to any R.R. station east of Denver. A booklet "How to Increase the size of your House (with paint)" free for the asking, or 18 actual combinations of proper house coloring for four 2-cent stamps, or free from our agents.

JAS. E. PATTON CO. Milwaukee, Wis., U.S.A.

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Apparatus for making the gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035** and **1038.** The most recent apparatus of simple and more elaborate type described and illustrated in special acetylene Supplement No. **1057.** Price 10 cents each. To be had at this office and from all newsdealers.

LINENE TRADE MARK REVERSIBLE COLLARS AND CUFFS.

RUBENS & CO.

MADE OF FINE CLOTH IN ALL POPULAR STYLES.

Equal in Fit and Wear to finest linen

Not to be laundered; when soiled reverse, then discard.

LUXURIOUS and ECONOMICAL.

Sold at all leading Gents' Furnishing Stores, but if not found send **twenty-five cents** for a box of **ten Collars** or **five pairs of Cuffs,** naming the size and style. ☞ *Sample Collar and pair of Cuffs sent for* **6 CENTS.**

REVERSIBLE COLLAR CO. Boston, 77 Franklin St., New York

RUST

ON GUNS, TOOLS, CYCLES, ETC. ABSOLUTELY PREVENTED BY USING - MANNOCITIN

SHORE GUNNERS SAY IT'S THE ONLY ABSOLUTE RUST-PREVENTIVE. 2 OZ. CANS 25 CTS. ASK FOR BOOKLET. O. GOETZE 116 BROAD ST. N.Y.

FISH You can catch hundreds of FISH if you put PATENT "GILLIS" on your bait. To advertise it, we mail anybody a $1 size package free for 10 cts. MARINE MNF. CO., PALATINE, ILLS. Drawer. 29

THE SCIENCE OF MECHANICS. DESCRIPTIVE CIRCULAR FREE. OPEN COURT PUB. CO. CHICAGO

ICE MACHINES. Corliss Engines. Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

$75 A MONTH AND EXPENSES; experience unnecessary; position permanent; self seller. **Pease Mfg. Co.,** Cincinnati, Ohio

Shorthand by Mail Thoroughly taught by reporters. *Catalogue and first lesson Free.* Potts Shorthand College, Williamsport, Pa.

BEST DRYING MACHINES FOR GRAIN, SAND-CLAYS, FERTILIZERS, GREEN COFFEE, WET SEEDS, ETC. 15 YEARS IN OPERATION. SEND FOR 6TH ILLTD CATALOGUE. S. E. WORRELL, HANNIBAL, MISSOURI.

TELEPHONES Send postal to manufacturers for their latest illustrations and descriptions with lowest prices. The **ALLEN-HUSSEY CO.,** 211-213 Randolph Street, Chicago.

FOR SALE—One New Sturtevant Blower No. 10, 77 inches high, inlet 24½ in. and outlet 24½ in. diameter. With pulley, etc., complete. Eclipse Printing Ink Co., Ltd., Franklin, Pa.

WELL DRILLING AND PROSPECTING MACHINERY OF HIGHEST GRADE. **LOOMIS CO., Tiffin, Ohio.**

TURBINE WATER WHEELS. SEND FOR PAMPHLET. **JAMES LEFFEL & CO., Springfield, Ohio, U. S. A.**

STENCIL MACHINES AND OUTFITS TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

WANTED A BICYCLE Novelty in Sheet Metal or Wire to manufacture by contract for 1897 trade.

L. R. HITCHCOCK, WATERTOWN, CONN.

INDUCTION STATIC MACHINES

F. F. WOOD, REEDSBURG, WIS., will build to order any size, with any number of plates, up to 30 in. in diameter, giving from 2 to 12 in. sparks, for X-ray and experimental purposes. Correspondence solicited.

Howard Chainless Bicycle.

The first man in any town who buys one will be allowed an agent's discount and offered an agency, whereby he gets commissions that will pay for his wheel, or at least reduce the cost. Address HOWARD, 771 Summer Av., Newark, N.J.

VOLNEY W. MASON & CO.

FRICTION PULLEYS, CLUTCHES, and ELEVATORS

PROVIDENCE, R. I.

CARBORUNDUM HARDEST ABRASIVE KNOWN. EMERY AND DIAMOND POWDER SUBSTITUTE. IN FLOUR, POWDER, CRYSTAL, WHEEL, SLAB & HONE FORM. *CARBORUNDUM CO. MONONGAHELA CITY, PA. U.S.A.*

MANUFACTURE OF STARCH FROM Maize.—By J. Kriegner. Full details of the process. With one illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1012.** Price 10 cents. To be had at this office and from all newsdealers.

INVENTORS OF SPORTING SPECIALTIES WILL FIND IT OF ADVANTAGE TO CORRESPOND WITH AND SUBMIT THEIR ARTICLES TO H. P. O. BOX 2308 NEW YORK.

HYPNOTISM Sixty methods, $5; my process $2, 100 page book, 10c. Key to Power, 30c. Prof. Anderson, S. A. 8, Mason c Temple, Chicago.

© 1896 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

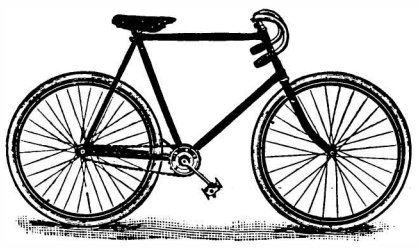
Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Tribune Bicycle

Tested and True.



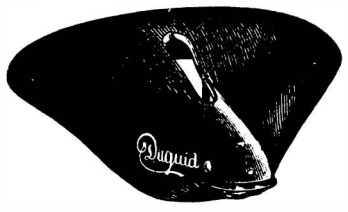
The Easiest Running Wheel in the World.

☞ *Send for Catalogue.*

THE BLACK MFG. CO., ERIE, PA.

THE BICYCLE: ITS INFULENCE IN Heath and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

THE Duguid CYCLE SADDLE



for Ladies' use. Broad and comfortable, and guaranteed to hold its shape. Most sensible and serviceable Saddle in the market. Twenty years' experience in working leather enables us to make good this claim.

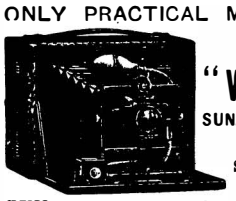
ALL STYLES GENTLEMEN'S SADDLES also. Ask for the Duguid. If your dealer will not supply you, we will send, prepaid, on receipt of price: Ladies', $4.00; Gentlemen's, $3.50. *Furnished with clip for T or L seat post.*

THE DUGUID SADDLERY CO., Syracuse N Y.

The $5.00 POCKET KODAK

EASTMAN KODAK CO.,
Sample photo and booklet for two 2-cent stamps. ROCHESTER, N. Y.

ONLY PRACTICAL MAGAZINE CAMERA.



SUNART'S "VENI, VIDI VICI,"

SUNART MAGAZINE, SUNART FOLDINGS.

Send for Illustrated Catalogue—2 cent stamp.

SUNART PHOTO CO., ROCHESTER, N. Y.

The American Bell Telephone Company,

125 Milk Street, Boston, Mass.

This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

The No. 2 Hammond

Possesses

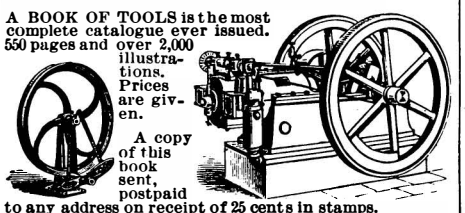
ALIGNMENT—Perfect and permanent.
IMPRESSION—Invariably uniform.
TOUCH—Soft, light and elastic.
SPEED—206 words a minute.
DURABILITY—The fewest parts, the best made
VARIETY—12 languages, 37 styles of type, paper or cards of any width or size on one machine.
PORTABILITY—Weighs only nineteen pounds complete, with traveling case.

THE HAMMOND TYPEWRITER CO., - 401 East 62d Street, - NEW YORK

What Do You Want

in the way of mechanical tools? What would you like to know about them? All information in the "BOOK OF TOOLS."

A BOOK OF TOOLS is the most complete catalogue ever issued. 550 pages and over 2,000 illustrations. Prices are given.



A copy of this book sent, postpaid to any address on receipt of 25 cents in stamps.

CHAS. A. STRELINGER & CO.
Address Box 12½, Adv. Dept. DETROIT, MICH.

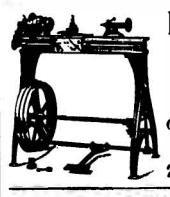
AGENTS WANTED WRITE FOR CATALOGUE AND AGENCY. FOR FINE TOOLS IN EVERY SHOP. **C.H.BESLY & CO.** CHICAGO, ILL. U.S.A.

HAVE YOU GOT OUR CATALOGUE L FOR 1896 OF

GAS AND GASOLINE STATIONARY ENGINES
GASOLINE TRACTION ENGINES
COMBINED ENGINES AND PUMPS
GASOLINE PORTABLE ENGINES

USED ANY PLACE BY ANY ONE FOR ANY PURPOSE

CHARTER GAS ENGINE CO., Box 148, Sterling, Ill.



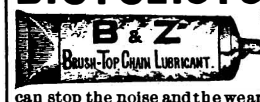
BICYCLE REPAIR OUTFITS

for Amateur and Workman.

☞ *Send for List 223. Illustrated Catalogue of tools for stamp.*

FRED FRASSE CO.
21 Warren Street, New York

BICYCLISTS BEWARE



Stop that "chafing" and "wheezing" of your bicycle chain! It means friction, and friction retards progress and lessens speed. You can stop the noise and the wear too by one application of **The B & Z Brush-Top Chain Lubricant,** which creeps into the joints and stays there, preventing both friction and rust and making the machine run easier. Ask your dealer or mailed for a quarter.

BERGANG & CO., Asbury Park, N. J.

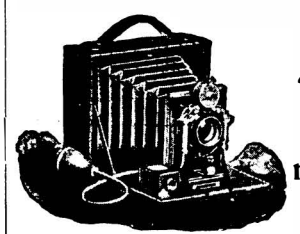
DIXON'S 691 CYCLE CHAIN GRAPHITE

saves wear of chain, prevents rust and increases ease, speed and comfort.

☞ It will pay you to send 10 cents for sample.

JOS. DIXON CRUCIBLE CO., JERSEY CITY, N. J.

The . . . Premo Camera



Styles for 1896 now ready

ROCHESTER OPTICAL CO., Rochester, N. Y

JUST OUT!

50th Anniversary Number

. . . OF THE . . .

"Scientific American."

In this issue is published a résumé of the progress of the Industrial Arts and Sciences during the past fifty years No expense or pains have been spared to make this a publication of rare merit and great value. The articles have all been prepared by specialists. Some of the principal subjects treated are

50TH ANNIVERSARY NUMBER
SCIENTIFIC AMERICAN
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.
MUNN & CO. 361 BROADWAY NEW YORK

Reduced Fac-simile of Cover Page.

The Transatlantic Steamship.
Naval and Coast Defense.
Railroads and Bridges.
The Sewing Machine.
Physics and Chemistry.
Electric Engineering.
Progress of Printing.
The Locomotive.
Iron and Steel.
Phonograph.
Photography.
Telegraph.
Telephone.
Telescopes.
The Bicycle.
History of the Scientific American.

Many other articles of great interest, by the best scientific writers of the day, are also published, among the most important of which is the prize essay, entitled

"THE PROGRESS OF INVENTION DURING THE PAST FIFTY YEARS,"
FOR WHICH A PRIZE OF $250 HAS BEEN AWARDED.

Probably never before has so much valuable information of historical interest and importance been published in so condensed and popular a manner. It will form a valuable addition to any library, and should be in the hands of all who desire to keep abreast of the times.

☞ 72 PAGES PROFUSELY ILLUSTRATED. COVER IN COLORS. **PRICE 10 CENTS.**
Mailed to any address in the United States, Canada or Mexico. To foreign countries add 8 cents extra for postage. For sale by all Newsdealers throughout the country or address

MUNN & CO., Publishers of the "Scientific American," 361 Broadway, New York.

☞ Send for our booklet on Patents, Caveats, Trade Marks, Copyrights, etc. Also 116 pp. Sci. Book Catalogue.

CRITERION

Stereopticons, Magic Lanterns and Accessories.

Triple Stereopticon for Projecting Views in Natural Colors.
Slides for Projection in Natural Colors.

X RAY LANTERN SLIDES.

and other novelties. *Self Centering Arc Electric Focusing Lamps for Theatres, Photo-Engravers, etc.*

J. B. COLT & CO.,
115-117 Nassau St. } New York.
and 59 Fifth Ave., }
Send for Catalogue.

AGENCIES.
189 La Salle St., Chicago, Ill.
131 Post St., San Francisco, Cal.
50 Bromfield St., Boston, Mass.
33-39 So. Tenth St., Phila., Pa.
415 N. Broadway, St. Louis, Mo.
126 Erie Co. Bank Bldg., Buffalo, N. Y.
23½ Marietta St., Atlanta, Ga.

HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

PREISTMAN SAFETY OIL ENGINE

"A thoroughly successful commercial Engine using a Safe Oil."—Franklin Institute

No Extra Insurance, No Steam, No Gas. No Gasoline. Reliable, Safe, Economical, and Convenient. Chosen by Nine Governments. Used for nearly every purpose.

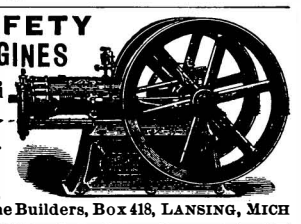
PREISTMAN & CO., Incorp'd, 530 Bourse Bldg., PHILADELPHIA, PA.

The Chicago Gas & Gasoline Engine

The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength. *Catalogue sent on application.*

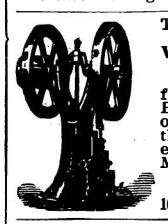
MANUFACTURED BY
J. J. NORMAN CO.,
48 "A" South Clinton St.,
CHICAGO, ILL.

OLDS SAFETY VAPOR ENGINES



FREE from cams, gears, rockarms and complications. Greatest simplicity, efficiency, and durability. *Get catalogue by sending 2 2-cent stamps.*

P. F. OLDS & SON,
The Gasoline Engine Builders, Box 418, LANSING, MICH



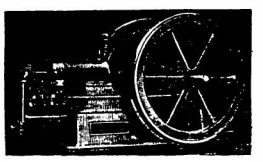
This beats Wind, Steam, or Horse Power. We offer the WEBSTER 2½ actual horse power

GAS ENGINE

for $150, less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100, therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline.

☞ *Write for Special Catalogue.*
WEBSTER MFG. CO.
1074 West 15th Street, CHICAGO

Improved Witte Gas and Gasoline Engines



Latest and Best. 1½ to 50 H. P. The result of 6 years' experience. Requires only 3 minutes to develop full power. Simple, Durable, Reliable. Sent on trial to reliable firms and guaranteed for one year.

☞ *Send for illustrated circular "S. A."*

Witte Iron Works Co., 1207 Walnut St., Kansas City, Mo.

At ¼ Price Bicycles, Watches Guns, Buggies Harness, Sewing Machines Organs Pianos Sales, Tools Scales of all varieties and 1000 other articles Lists free CHICAGO SCALE CO., Chicago Ill.

Typewriter Patent

This company owns Letters Patent No. 558,428, issued April 14, 1896, covering broadly all machines in which the cylinder turns up to expose the line of print, or in which a duplex or cross ribbon feed is used. The patent also covers many other features of modern typewriter construction. Infringers will be vigorously prosecuted.

Wyckoff, Seamans & Benedict.
327 Broadway, New York.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts. Philadelphia, and 47 Rose St., opp. Duane, New York

© 1896 SCIENTIFIC AMERICAN, INC.